TECHNOLOGY DEPT.

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MODERN PLASTICS

MAY 1945

LET'S GET DOWN TO CASES—OF PLASTIC

● *Typical of the ingenuity of American industry in developing new products and improving old ones with plastics is the above-illustrated plastic binocular case which was produced by the Hood Rubber Company for Bausch & Lomb Optical Company.*

Due to the vital importance of binoculars to the Armed Forces, it was absolutely essential that these instruments be carefully safeguarded against injury.

In the quest for the ideal material, eight different types were considered. Of these, only one successfully passed all the requirements for binocular cases. This was a laminated and molded plasticized vinyl reinforced with Durez phenolic-impregnated fabric and other materials.

This new case passes the accelerated-weathering (240-hr. test), salt-spray (100-hr. test), impact-resistance (4 ft., -50° F.), accelerated-warp (7 days, 160 to -10° F.), flexural-resistance (1½-in. radial bend), abrasion-resistance, and construction tests as set up by the U. S. Navy. Another interesting feature is the resistance to fungi and bacterial growth which this case possesses, to the extent that the binoculars themselves are immunized.

The versatility of Durez phenolic plastics has made their use almost universal throughout industry. Such properties as dimensional stability at temperature extremes, diversity of finishes, dielectric strength, and resistance to moisture, heat, acids and alkalies, render them invaluable to the imaginative design engineer.

Perhaps you are searching for a material for some product which you intend to market in the post-victory era. If so, we suggest that you take advantage of the wealth of experience which Durez technicians have available for your benefit at all times. You are always assured of the complete cooperation of the Durez staff to help you solve plastic material problems. Durez Plastics & Chemicals, Inc., 265 Walck Road, North Tonawanda, N. Y.

DUREZ

PHENOLIC RESINS

- MOLDING COMPOUNDS
- INDUSTRIAL RESINS
- OIL SOLUBLE RESINS

PLASTICS THAT FIT THE JOB

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It consists of a "free wheeling" disc, 1" in circumference, mounted on a pencil-sized handle. Both are made of Catalin. Its operation is accurate and *fascinating*. Each complete revolution of the calibrated wheel transmits an impulse to the operator's fingers, enabling a mental count of the traveled inches. Fractional turns are read directly from the dial. To prevent slippage and wear, the wheels, cut from Catalin rods, are embedded in carborundum. The repeating impulse effect is produced by a flat spot on the wheel's edge directly under the arrow indicator.

This is but one of the many applications to which dimensionally stable Catalin is ideally suited. Postwar, countless new products, too, will take advantage of Catalin's gem-like and *materially* superior qualities. To assist you in planning for them, Catalin's technical staff is readied now with suggestions and the desire to serve you. Inquiries invited

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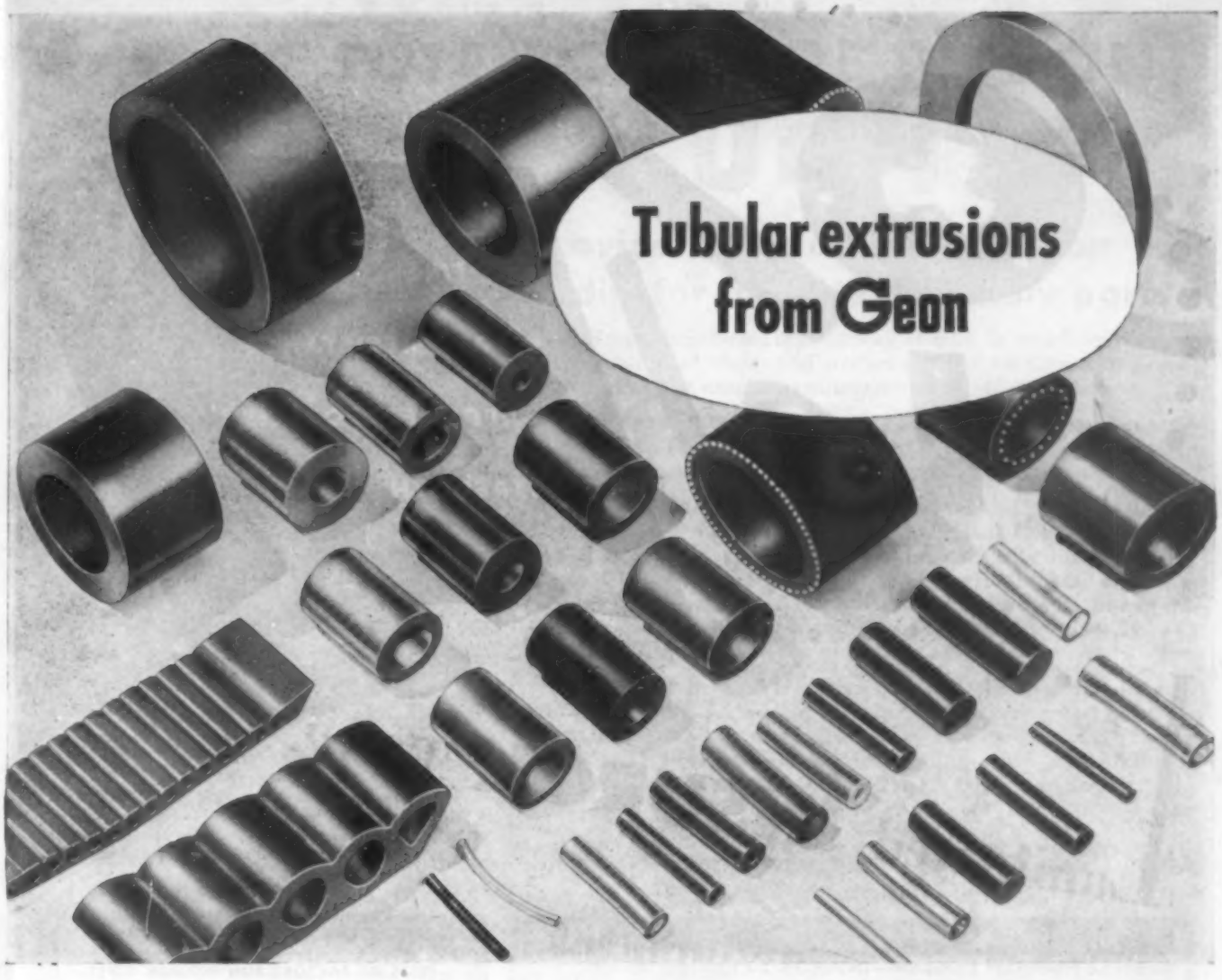

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THOSE tubular sections represent a score or more of applications for GEON polyvinyl materials. There's "spaghetti", 10/1000" inside diameter, for slipping on radio and switchboard wire. It's brightly colored for quick identification. There's tasteless, non-toxic beverage tubing for bringing beer from the basement to the bar. There's hose that resists the action of acids under high pressure. And many, many others. Some are flexible—others rigid. Some are black—others brilliantly colored. All were processed on standard machinery.

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Urgently needed for military uses, all the GEONS are subject to allocation by the War Production Board. Limited quantities are available for experiment, and our development staff and laboratory facilities will help you work out special problems or applications. For more complete information write Department II-5, Chemical Division, The B. F. Goodrich Company, 324 Rose Building, Cleveland 15, Ohio.

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TESTS OF FACTORY-RUN INSUROK T-712
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Tensile strength ⅛" thickness	
Lengthwise	45,600 psi.
Crosswise	37,900 psi.
Flexural strength ⅛" thickness	
Lengthwise	53,700 psi.
Crosswise	50,400 psi.
Compressive strength	
Flatwise (½"x½"x½")	97,800 psi.
Edgewise (½"x½"x½")	
Lengthwise	29,460 psi.
Crosswise	24,600 psi.
Impact strength Izod method per inch of notch	
Flatwise (½"x¼")	
Lengthwise	Greater than 33 ft. lbs.
Crosswise	27.4 ft. lbs.
Edgewise (½"x¼")	
Lengthwise	18.8 ft. lbs.
Crosswise	16.5 ft. lbs.
Bond strength ½" thickness	1,800 lbs.
Arc Test	185 sec.
Moisture Absorption ⅛" thickness	
24 hours in water at 77° F.	1.84%
Dielectric Constant	5.65
Loss Factor	.0521
Dielectric Strength	
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The Solution: Modernization of containers by fabricating them from crystal-clear, light-weight Du Pont "Lucite." A total of 4495 different component parts makes possible 63 different compartment arrangements.

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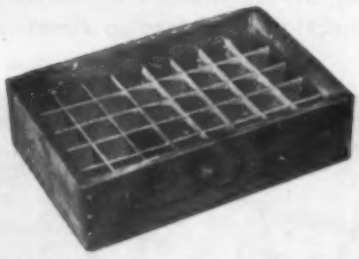
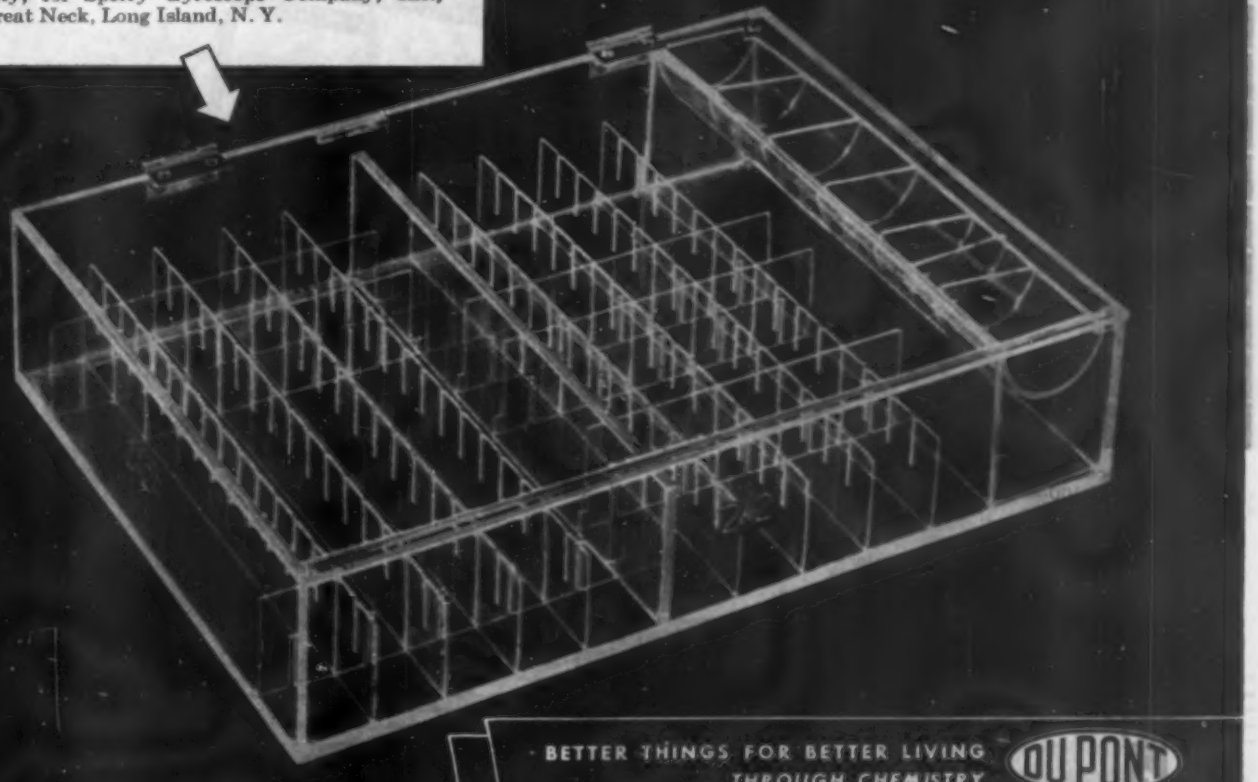
Du Pont "Lucite" is at present available for war applications only. WPB-allocated quantities for experimental purposes can be obtained by writing. Address: E. I. du Pont de Nemours Co. (Inc.), Plastics Department, Arlington, N. J., or 5801 S. Broadway, Los Angeles 3, Calif. In Canada: Canadian Industries, Ltd., Box 10, Montreal.

FOR PLASTICS . . CONSULT DU PONT



The OLD Way: Tote boxes made of pine wood, with plywood bottoms and cardboard separators. These boxes were hard to keep clean, splintered, and crevices collected dirt and dust particles.

The NEW Way: Tote boxes made from transparent DuPont "Lucite" methylmethacrylate resin sheeting. Fabricated by Dura Plastics, Inc., New York City, for Sperry Gyroscope Company, Inc., Great Neck, Long Island, N. Y.



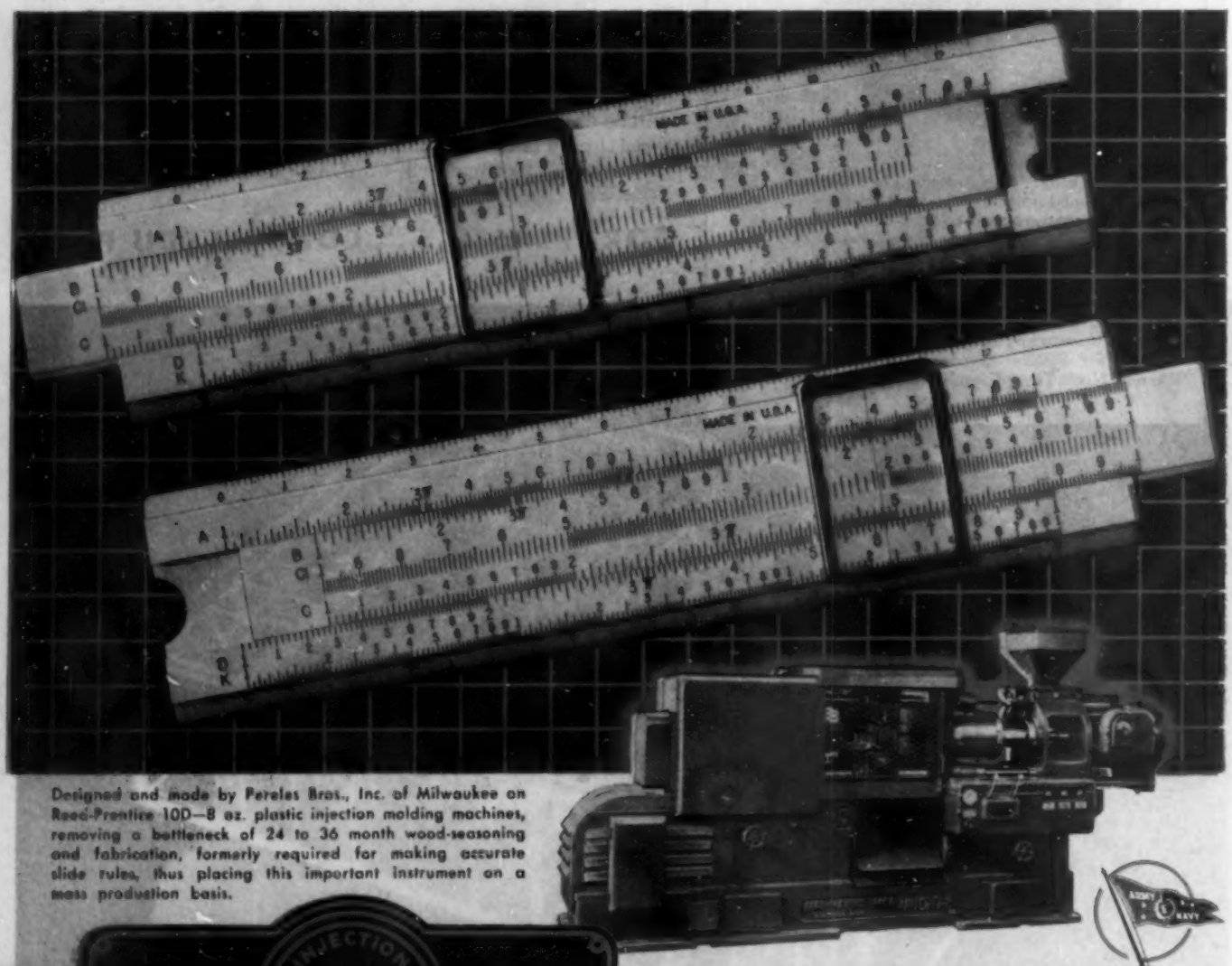
BETTER THINGS FOR BETTER LIVING ...THROUGH CHEMISTRY

DU PONT

SIMPLE ARITHMETIC

SIMPLE ARITHMETIC... when the slide rule is accurate to one ten-thousandth of an inch. Not so simple as an engineering problem when building the mold for this plastic marvel. This new triumph in exact mold registration by Reed-Prentice machines is further indication of how the molding of plastics to machine tool tolerance will enable a constantly increasing variety of new plastic products to dominate markets in the post-war era.

Many manufacturers are solving tomorrow's plastic production problems by consulting Reed-Prentice today. Write for complete details concerning Reed-Prentice "Engineered Service." This unique service offers you the benefit of wide experience in plastic mold design and the authoritative counsel of the makers of the largest selling line of plastic injection machines in America.



Designed and made by Pereles Bros., Inc. of Milwaukee on Reed-Prentice 10D—8 oz. plastic injection molding machines, removing a bottleneck of 24 to 36 month wood-seasoning and fabrication, formerly required for making accurate slide rules, thus placing this important instrument on a mass production basis.

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The Lumarith* *X* components must fit precisely to insure vital protection. 1/64" lenses must curve to exact specifications—sealing discs in angle tube must be airtight. All the way through Lumarith *X* assures dimensional accuracy, toughness.

WATER TESTING KIT

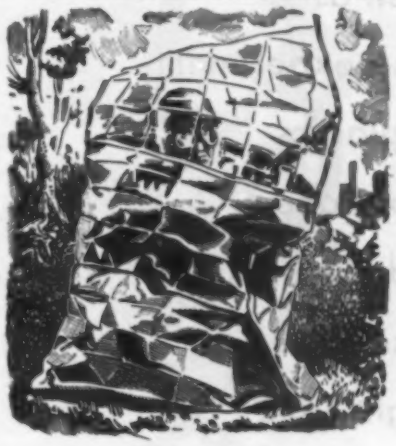
This rugged Lumarith* E. C. (ethyl cellulose) container protects a set of chemicals used to test water supplies for advancing fighters. Color-reaction comparison specimens secured to the cover can be clearly seen yet protected against weather factors.

COMBINATION FLASK

First it serves as a container for emergency rations and medical supplies, then—when sealed with accompanying pressure-sensitive tape—as a flask for emergency water supply. It's made of tough, waterproof, non-shatterable Lumarith E.C.

EMERGENCY FISHING KIT

Here's a real meal ticket for downed flyers awaiting rescue. Directions are permanently stamped in the container. The kit even includes a plastic lens for starting a fire. The material — Lumarith* C.A. — is water, mold and fungi proof, exceptionally tough.



GAS CAPE

Fabric, metal foil, cellophane and Lumarith foil effectively team up to protect GI Joe from poison gases. The cape is sealed with pressure-sensitive tape backed with Lumarith. For the container, Lumarith supplies waterproofness, toughness, fold strength.

RESCUE SIGNAL LIGHT

Signalling through darkness to rescue parties at sea, this Lumarith *X* encased battery lamp saves many a downed flyer's or seaman's life. It's tough, watertight, shockproof—qualities that have made Lumarith plastics outstanding.

IN HUNDREDS of applications—on land, at sea, and in the air—Lumarith meets new and exacting requirements for high impact strength, waterproofness and dimensional stability.

From spiral wound Lumarith containers for medical items, to Aero Quality Lumarith sheets for cockpit enclosures, a wide range of formulations score new highs in tensile strength, flexural capacity and surface resistance.

Lumarith* E. C. particularly stands out for high impact strength and dimensional stability even under extremes of humidity and temperature.

Our technical staff has helped to simplify any number of war production problems in plastics. Why not take advantage of this service? Celanese Plastics Corporation, a division of Celanese Corporation of America, 180 Madison Avenue, New York 16, N.Y.

*Reg. U. S. Pat. Off.

A Celanese Plastic*

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loves plastics
any more than we do.
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of brilliant successes
as well as
unwise experiment
with plastics
is a big one.
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you see it.
It might save
some headaches.

HAVE YOU A PLASTICS PROBLEM?

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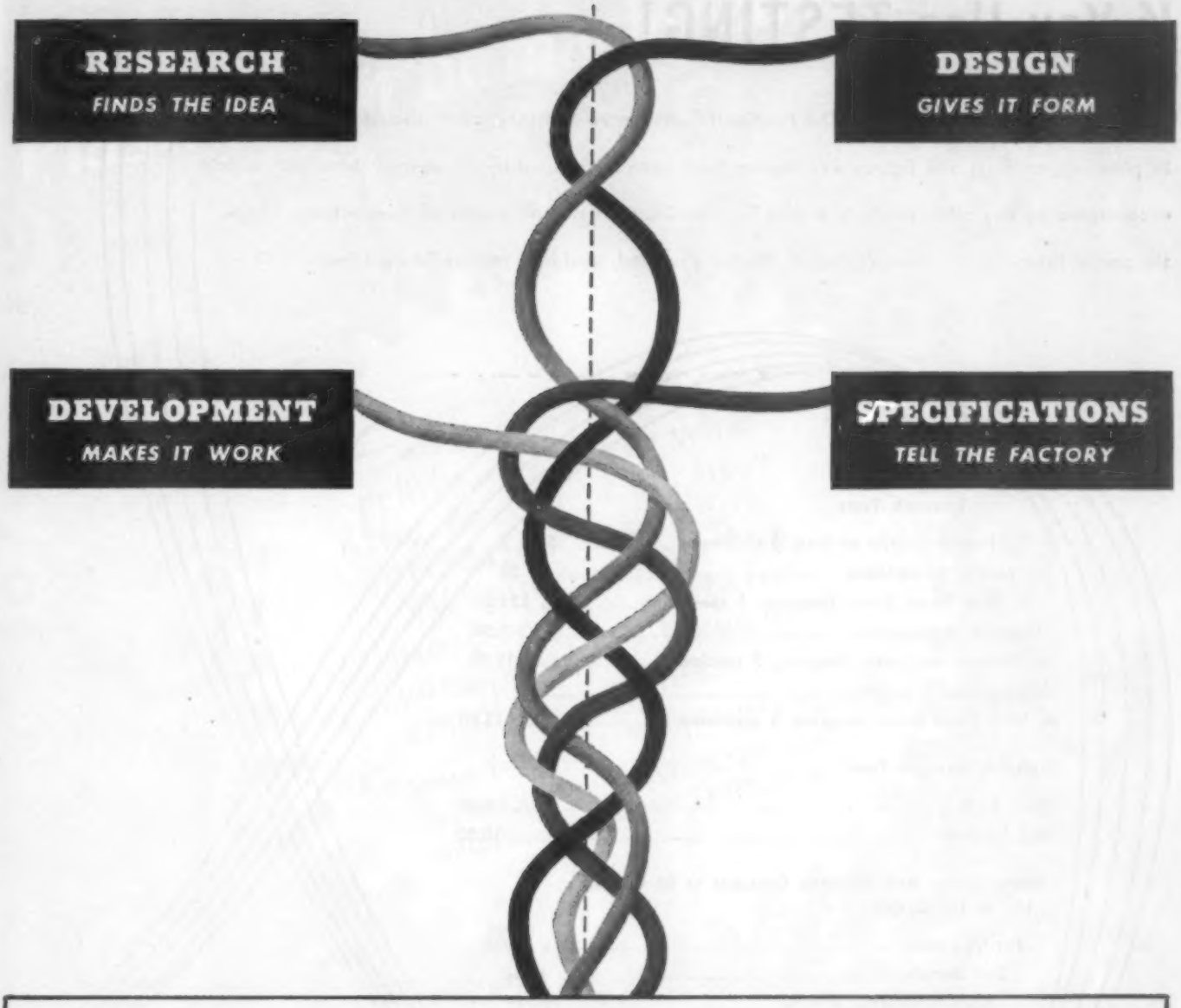
Pro-phy-lac-tic Brush Co., FLORENCE, MASS.

WEAVING COMMUNICATION HIGHWAYS



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A. With Stress Strain Diagram, 5 specimens	12.00
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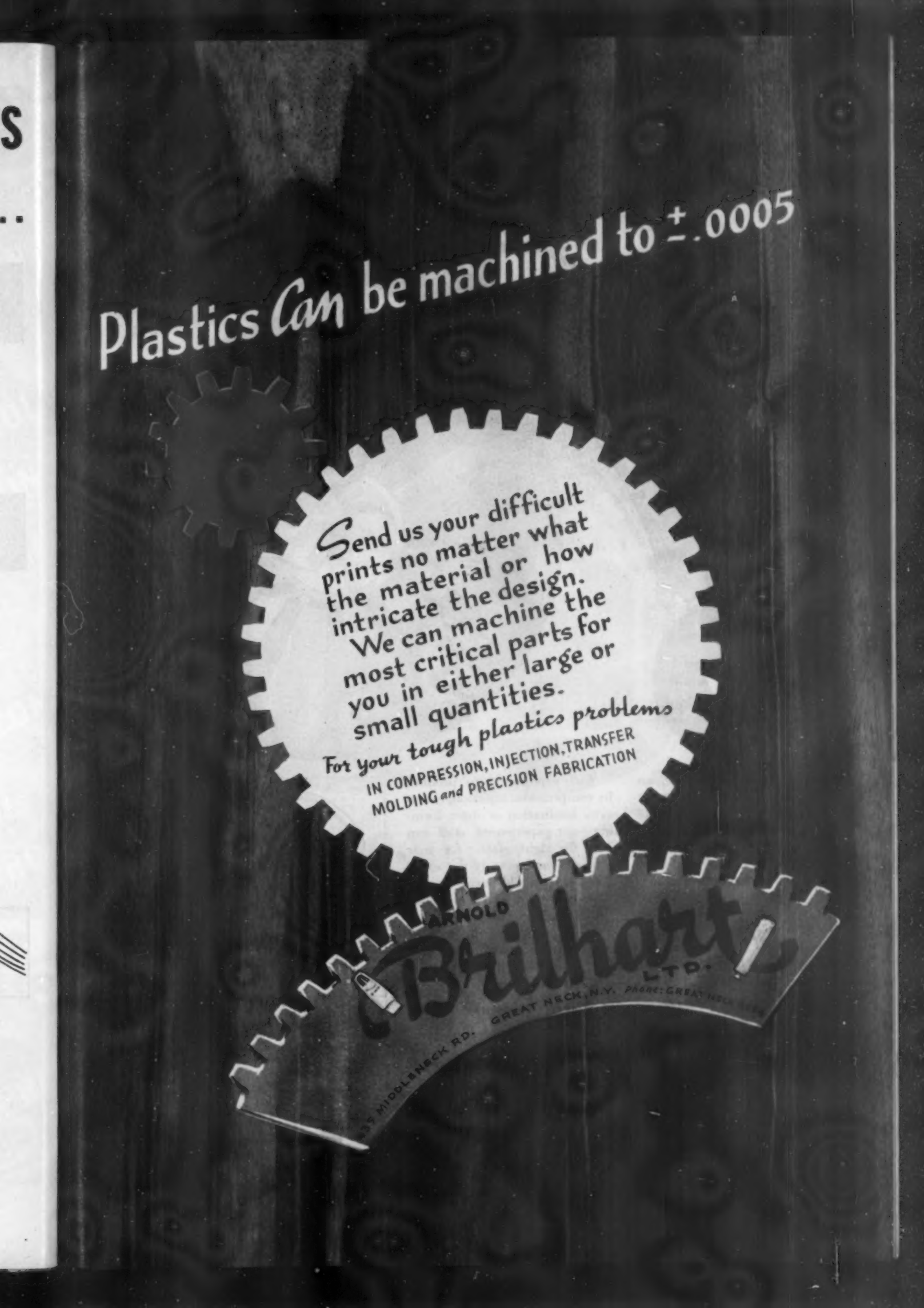
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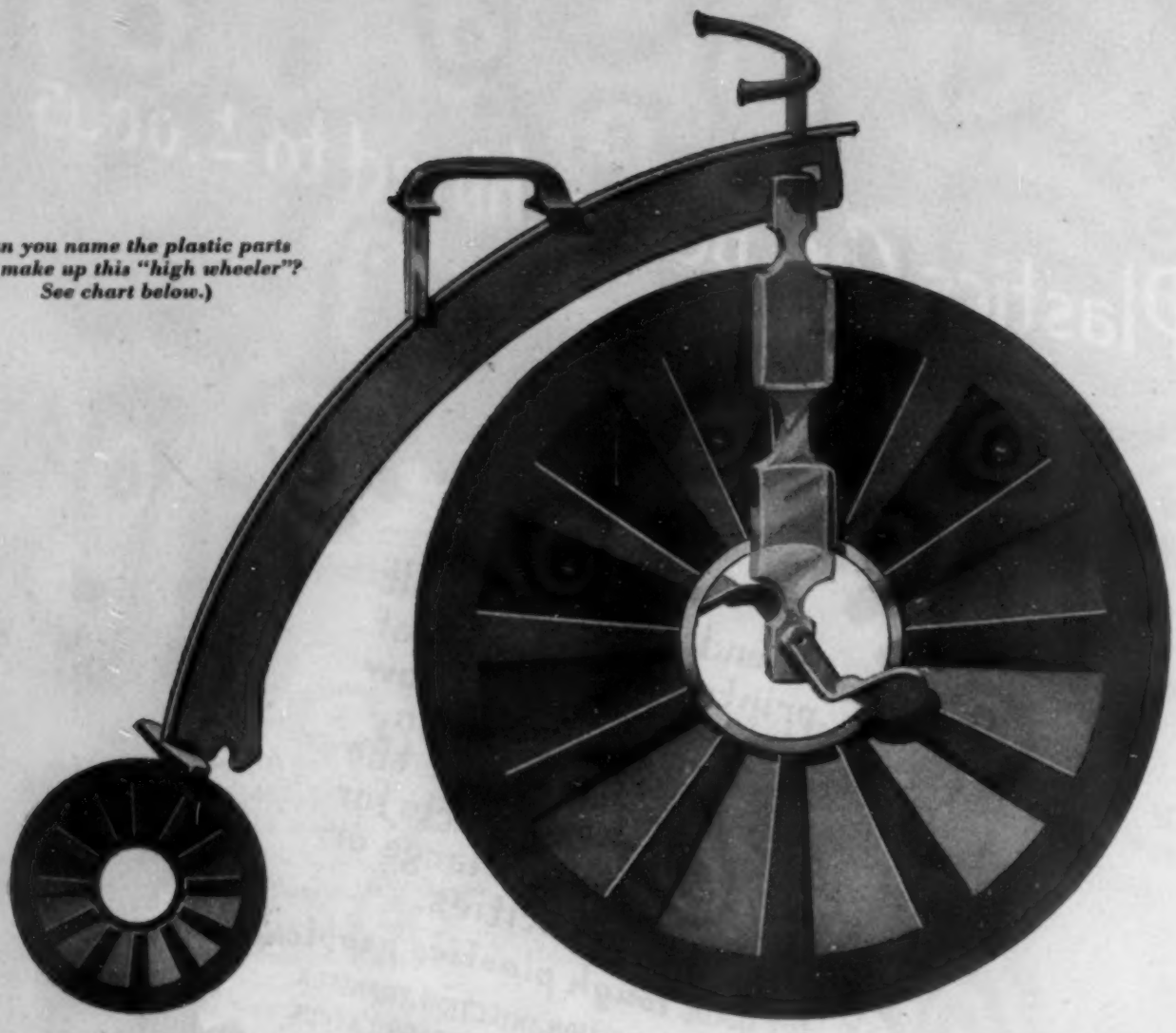
IS YOUR PRESENT PRODUCT OUT OF DATE?

(Can you name the plastic parts that make up this "high wheeler"? See chart below.)



Plastic bicycle? No, just an artist's way of showing you some of the varied products and parts made by Continental's Plastics Division.

If we placed end to end all the plastic items we're now making, they'd stretch quite a distance. New uses are being found for plastics almost every day. Continental takes the lead in converting these discoveries into practical application.

With equipment to produce by compression, injection, extrusion, lamination or sheet forming—our experienced staff can plan the right plastic for your product—and give it the exact features it should have.

So count on Continental for the latest and best in plastics. You'll find an alert, progressive organization qualified to give sound, practical advice and assistance at all times.

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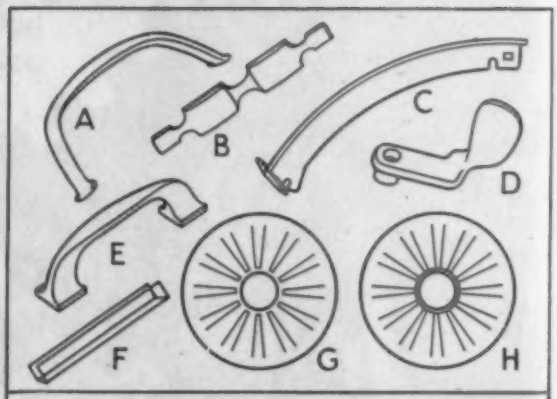

(a) Air scoop mounting—compression; (b) Hairbrush handles—injection; (c) Segment for circular file—injection; (d) Latch—injection; (e) Drawer handle—injection; (f) Molding—extrusion; (g) 3-piece sheave for variable—compression; (h) Ball retainer—compression.

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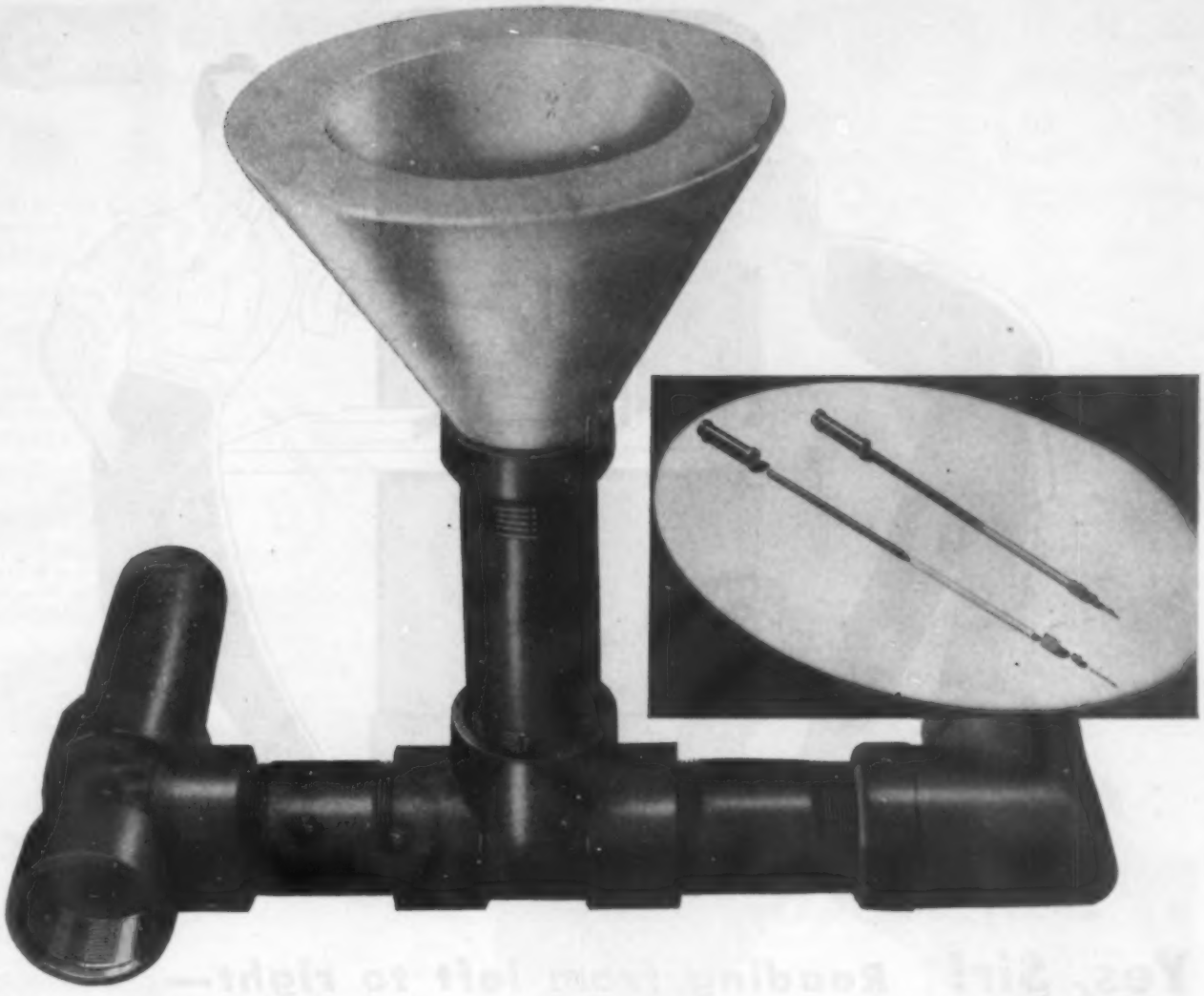
TECKNA



Heavy Pipe Assembly or Delicate Pipette

SARAN READILY FILLS BOTH REQUIREMENTS

A little ingenuity and some stock Saran Plastic go a long way in developing new, useful products, particularly when you need something to resist the action of corrosive materials . . . Shown here are only a few of the things we have developed in our own laboratories to meet industrial needs. On the top is an anti-splash acid funnel made from a sheet of Saran and half of a pipe coupling. The whole unit is attached to a heavy Saran pipe assembly. In the insert is a delicate pipette made from Saran rod and tube. All were cut from stock material and welded by simple methods with tools readily available. It will pay you to investigate the versatility of Saran Plastic Pipe, Tube, Sheet, Rod and Molded Fittings . . . Send for our latest P-11 Technical Bulletin, just off the press, which illustrates methods of welding Saran. Let us put you on the list to receive our coming new P-12 Bulletin covering the fabrication of Saran.

*SARAN

HODGMAN RUBBER COMPANY

*U. S. Pat. No. 2160931

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Saran tube, pipe fittings, sheet and rod. Extruded products of rubber and plastic. Horco Coated Fabrics.

Yes, Sir! Reading from left to right— a distributor head, a fuse box and a housing!

Not yet, but soon. And because we've pre-formed the molding compounds this way, each one will be a better, more economical plastic molding job.

There are so many advantages to using these pre-forms (molding compounds compressed into "pills" or roughs of the finished molding) that we've worked out special techniques for it here at Kurz-Kasch. Equipment is conventional—single and multiple-punch machines for small jobs and hydraulic presses for larger ones up to 1500 grams. But we set every press in a separate room so as to knock out the slightest chance for confusion of materials. What's more, every room is dust-proofed as well as air conditioned for perfect chemical and color control.

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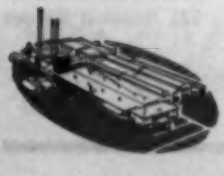
Have you asked for your free copy of *A Businessman's Guide to Plastics?* Address Department 7, please, on your letterhead—we'll send it at once with our compliments.

Kurz-Kasch



For over 28 years Planners and Molders in Plastics

Kurz-Kasch, Inc., 1415 South Broadway, Dayton 1, Ohio. *Branch Sales Offices:* New York • Chicago • Detroit Indianapolis • Los Angeles • Dallas • St. Louis • Toronto, Canada. *Export Offices:* 89 Broad Street, New York City

TYPICAL USES OF ROGERS-BORDS

BM-9725* disk for molding

3G443 back for binder

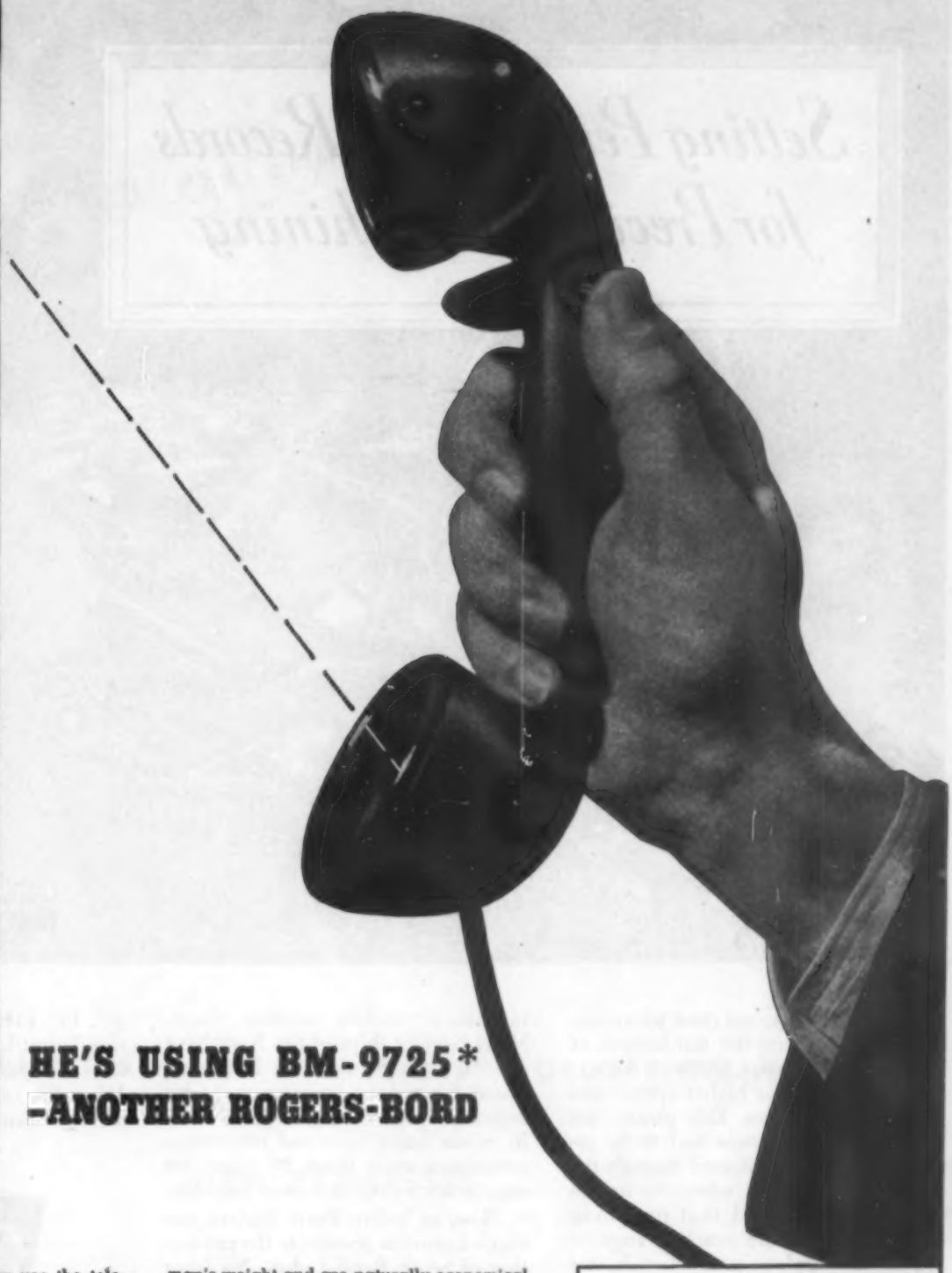
BAYRU cut for midsole

KAYGREY jewel box pieces

ROYALGREY insulator for transformer

3G316 as waste basket

XM-15000E cap for canteen



HE'S USING BM-9725* -ANOTHER ROGERS-BORD

PROBABLY every time you use the telephone you use another ROGERS-BORD, for most telephone handsets use this material — identified as BAKELITE molding plastic BM-9725 — for the mouthpiece or for strengthening the main molded structure.

ROGERS makes numerous other multi-purpose BORDS by the ROGERS PROCESS of wet-laminating cellulose fibers in various formulations. Molding BORDS are handled on conventional molding presses. All others can be formed, drawn, shaped and punched with a single stroke of a punch press — ready for use without curing, or they may be subsequently treated or painted.

The resultant products will support a man's weight and are naturally economical. The Fabricating Division of ROGERS is equipped to handle all punch press, drawing and stamping work, including die making. ROGERS does no plastic molding.

You probably already use a ROGERS-BORD every time you lift a telephone. You may profit by making your next call one for more data on ROGERS-BORDS. ***Write for the ROGERS-BORD SAMPLE BOX, containing numerous fabricated parts and samples of materials.***

ROGERS CORPORATION
Formerly
The Rogers Paper Manufacturing Co.
109 Mill St. Manchester, Conn.

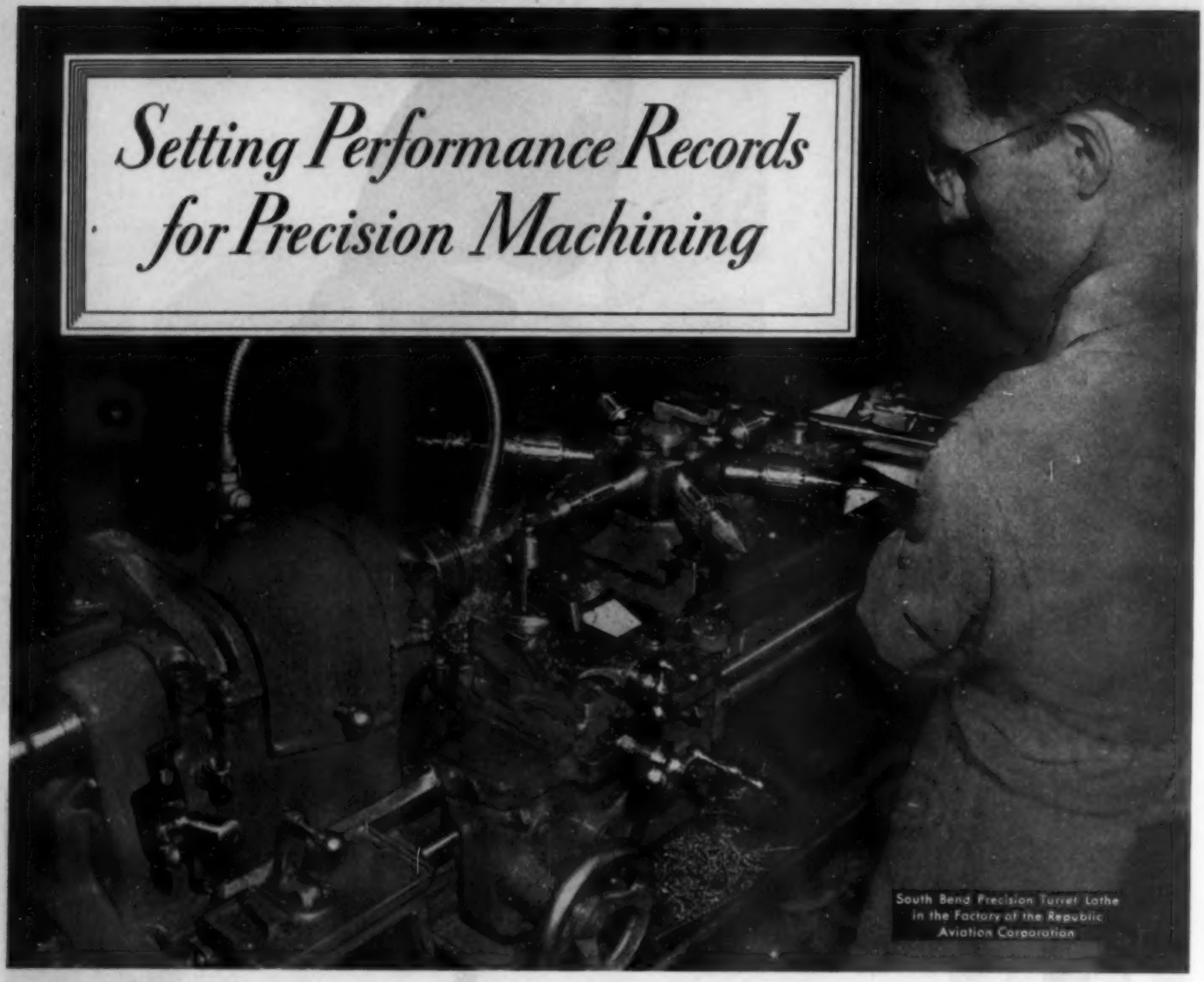
* ***"BAKELITE" BM-9725***

This ROGERS PROCESS blend of phenolic resin and cellulose fibers, made exclusively for the BAKELITE Corporation, comes in sheet, blanked or diced forms. It is a medium high impact thermosetting plastic . . . another ROGERS-BORD.

ROGERS

MANUFACTURERS AND FABRICATORS OF SPECIAL FIBROUS AND PLASTIC MATERIALS

Setting Performance Records for Precision Machining



South Bend Precision Turret Lathe in the Factory of the Republic Aviation Corporation

High precision and close tolerances have always been the watchwords of the aviation industry. But with the war came demands for higher speeds and better performance. This meant that even closer tolerances had to be established and maintained through the greatest production schedules in history. We are proud that providing lathes to meet the exacting requirements of warplane production is one of our important assignments. Throughout the aviation industry South Bend Lathes are setting enviable performance records for precision machining.

In all metal working industries, South Bend Lathes are giving the same dependable service that they are giving in the aviation industry. Versatile and efficient, they are also used for emergency service work by the Armed Services. They travel with the Army in compact mobile machine shops. Many fighting ships of the Navy have one or more South Bend Lathes on board for making emergency repairs at sea. They are used by the Air Forces in repair bases here and overseas—sometimes even flown by plane for emergency service in remote locations.

Now, as before Pearl Harbor, our entire factory is devoted to the production of South Bend Lathes. No other product is made by us. There has been no lowering of standards because of wartime restrictions and shortages. The use of substitute materials is negligible, limited to a few non-essential parts such as name plates, paint, etc. Improvements have been accelerated. Today, South Bend Lathes are better in every way.

South Bend Engine Lathes and Toolroom Lathes are made in five sizes: 9″, 10″, 13″, 14½″, and 16″ swing. Precision Turret Lathes are available in two sizes: Series 900 having 9″ swing with ½″ collet capacity, and Series 1000 with 10″ swing and 1″ collet capacity.

NEW CATALOG NOW READY!

Write For It!

Illustrated in full color—this new 64-page catalog shows all types of South Bend Lathes. Also shows complete line of accessories and attachments for use with these lathes. *Ask for Catalog No. 100-D.*

Lathe Builders For 38 Years

SOUTH BEND LATHE WORKS

442 East Madison Street • SOUTH BEND 22, INDIANA

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FOR IMPROVED PEACETIME PRODUCTS...

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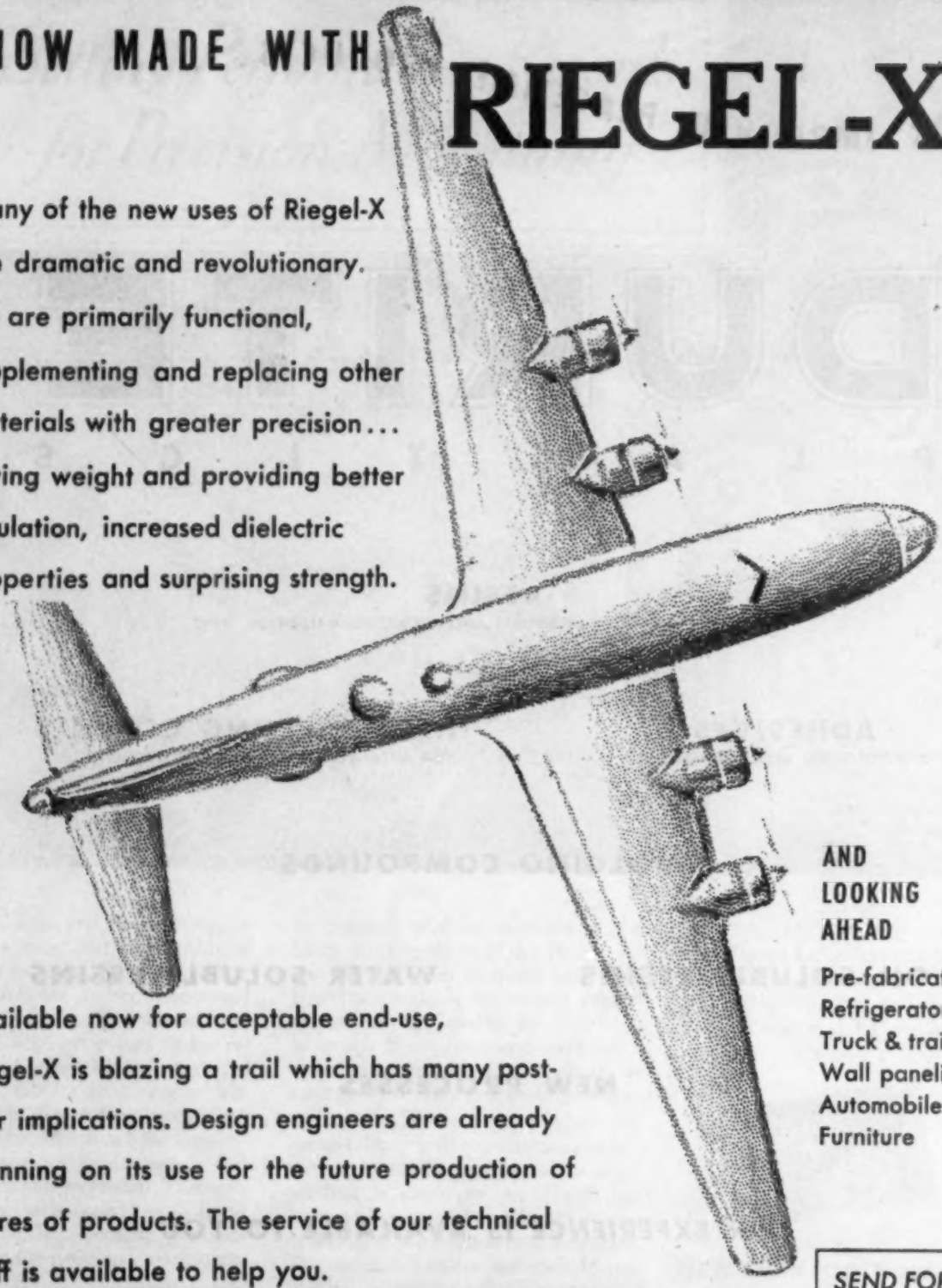
NOW MADE WITH RIEGEL-X

Many of the new uses of Riegel-X are dramatic and revolutionary. All are primarily functional, supplementing and replacing other materials with greater precision... saving weight and providing better insulation, increased dielectric properties and surprising strength.



Available now for acceptable end-use, Riegel-X is blazing a trail which has many post-war implications. Design engineers are already planning on its use for the future production of scores of products. The service of our technical staff is available to help you.

AND LOOKING AHEAD

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Refrigerators
Truck & trailer bodies
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RIEGEL PAPER CORP., 342 MADISON AVE., N. Y. 17, N. Y.

SEND FOR the new Riegel Bulletin on Papers for the Plastics Industry

RIEGEL-X

X A group of plain and impregnated base papers for high or low pressure laminates X

Glamour ...FOR SALE
New concepts of beauty to defy the imagination . . . that's Columbia's program for plastics when its creative skill and versatility are again applied to the arts of peace. Until then, remember . . . Columbia Plastics are blended of engineering knowledge, scientific research, design and production technique—seasoned with vision and ingenuity that makes plastic dreams come true.
COLUMBIA PROTEKTOSITE CO., INC. • CARLSTADT, N. J.
COLUMBIA Plastics

Now . . . a Smoother Way to Serve "Scotch"—

A REEL treat for the fingers! . . . A well balanced, simply designed, all-plastic "scotch tape" dispenser that doesn't give you an "all thumbs" feeling! Several features are worth noting: the strong, sharply defined cutting teeth are PLASTIC . . . molded-in, along with the spool structure. This cuts costs as well as tape—eliminates the need for a metal knife—saves extra assembling operations! A separate, circular, plastic cap secures to the drum by friction-fit. It locks and aligns the roll on the spindle. The cap's flat surface facilitates brand name identification. Should you, as was this item's manufacturer, be faced with product problems . . . call upon STERLING to see you through! Our injection molding know-how is experience-backed!

STERLING PLASTICS CO.

1140 COMMERCE AVENUE
UNION • NEW JERSEY

"Hair Trigger" accuracy of PANELYTE* PRECISION-FABRICATION SHOWN IN HAMILTON PROPELLER BLOCKS!

Final inspection — Micrometer indicators used to determine accuracy of machining of PANELYTE Barrel Support Block to assure exact tolerances.

The straight-line mass production of PANELYTE Barrel Support Blocks demands no less than 12 different machining operations. Manufactured for the Hamilton Standard Propeller for bomber and combat planes, this intricate part aligns and supports the controllable pitch mechanism, in relation to the housing. The slightest variation in any machining operation would result in faulty propeller performance.

Grinding, sanding, drilling, counterboring, and various kinds of milling are among the operations in the precision-fabrication of these PANELYTE Blocks. Three decimal tolerances are maintained on all critical dimensions. Ample facilities permit rapid mass production of this and other equally complex and essential structural parts.

Why not take advantage of the extensive, first-hand experience of the Panelyte Engineering Staff in designing, developing and producing fabricated and molded structural parts?

Vertical milling of 3" and ¾" radii on PANELYTE Barrel Support Block, milled to tolerance of ±.001" as curved surface must exactly fit inside contour of barrel.

Barrel Support Block of fabric base PANELYTE — Note complex design of part, 3 different size holes, and milled seat and milled oil groove.

PANELYTE *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
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NEW YORK 17, N. Y.

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* MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS IN PAPER, FABRIC, FIBRE GLASS, WOOD VENEER AND ASBESTOS BASE LAMINATES

PERFECT LETTERS AT 45 DEGREES

Have you a problem of molding an intricate part with letters and designs on sharp angles? Such jobs are almost daily routine at Midland where long experience and skill not only assure precision but perfect letters and designs.

With facilities that are unsurpassed for making plastic molds, die cast molds, and hobs, Midland will welcome the opportunity to make your molds and hobs that will assure efficient production.

We are holding for you a copy of our book "Shaping Tomorrow Today". Write for it!

D&E

MIDLAND DIE AND ENGRAVING COMPANY

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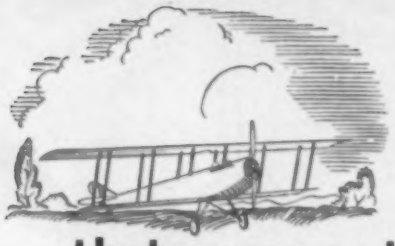

Another "Flying First" that grew out of *Plexiglas*

WHEN flying speeds climbed up over the 300 m.p.h. mark, PLEXIGLAS "greenhouses"—panels of plastic in a metal framework — were developed to protect fighter pilots from fierce winds and freezing slipstreams. Thus, strong, tough and permanently transparent, PLEXIGLAS helped make possible one of the major improvements over the Jennys and Allisons of World War I.

Now *another* Plexiglas development eliminates even the metal framework. The one-piece "bubble" canopy of tear-drop design gives the pilot better all-around visibility, unbroken by metal supports. It reduces wind resistance and drag with resultant gains in speed. It further increases the savings in weight already possible because of this remarkable plastic's inherent light weight.

The adaptation of vacuum and air pressures to fabricating large acrylic sheets is a Rohm & Haas development with far-reaching implications also for the fabricator and the buyer of plastic parts. For details on this fast, improved method, call our nearest office: Philadelphia, Detroit, Los Angeles, Chicago, Cleveland, New York. Canadian Distributor: Hobbs-Glass Ltd., Montreal.

ONLY ROHM & HAAS MAKES *Plexiglas* CRYSTAL-CLEAR ACRYLIC SHEETS AND MOLDING POWDERS

PLEXIGLAS is the trade-mark, Reg. U.S. Pat. Off., for the acrylic resin thermoplastic sheets and molding powders manufactured by Rohm & Haas Company.
Represented by Cia. Rohm y Haas, S.R.L., Carlos Pellegrini 331, Buenos Aires, Argentina, and agents in principal South American cities.

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WASHINGTON SQUARE, PHILADELPHIA 5, PA.

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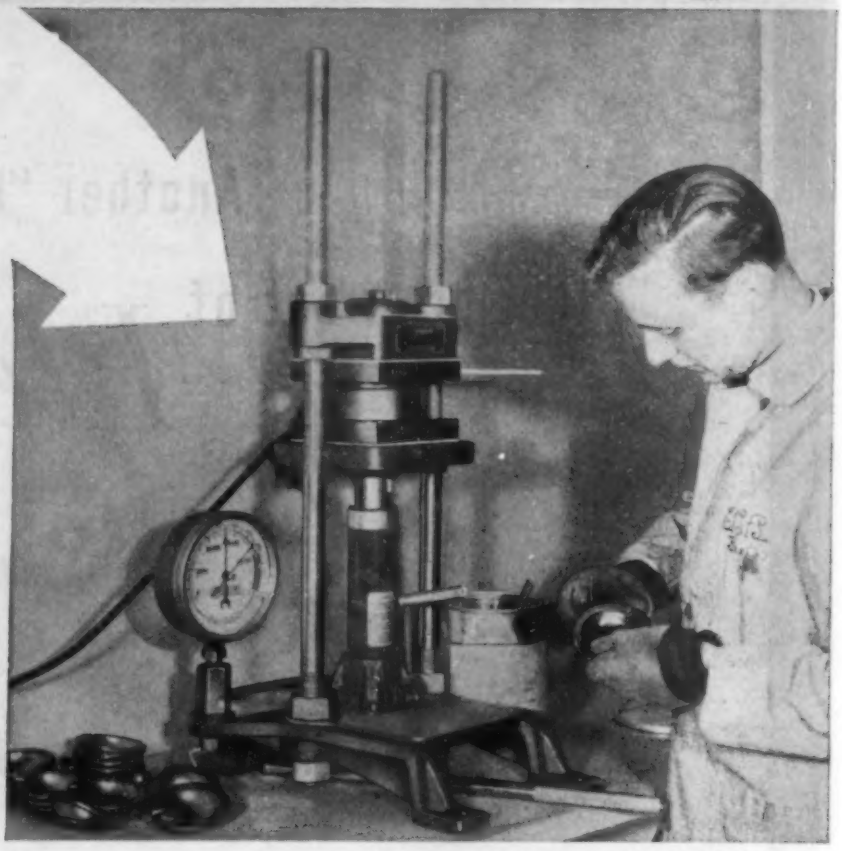
THE CARVER LABORATORY PRESS

STANDARD FOR RESEARCH AND DEVELOPMENT



Milestones in Plastics

It was in the postwar year of 1868. Patents were applied for on a composition made from shellac and sawdust, for the manufacture of knobs. Thus utilized in plastics development was shellac, the material whose humble origin is traced to the tiny Asiatic insect, *Coccus Lacca*.

In 1895, experiments with molding compositions using shellac resulted in the first molded phonograph records. Successful production of "talking machine" recordings quickly established the importance of shellac plastic material. Here, as in the development of other plastics, increasing research has continued to find new uses.

A few devoted scientists carried the burden of plastics development during the early years of the industry's existence. One of the handicaps faced by these pioneers was lack of research data in the field of their interest. Contrasted to the slow, arduous progress of their period, the last 15 years comprises a record of phenomenal growth. This is the period of extensive research and experimental activity. An indispensable aid during this time has been the Carver Laboratory Press. The press is standard

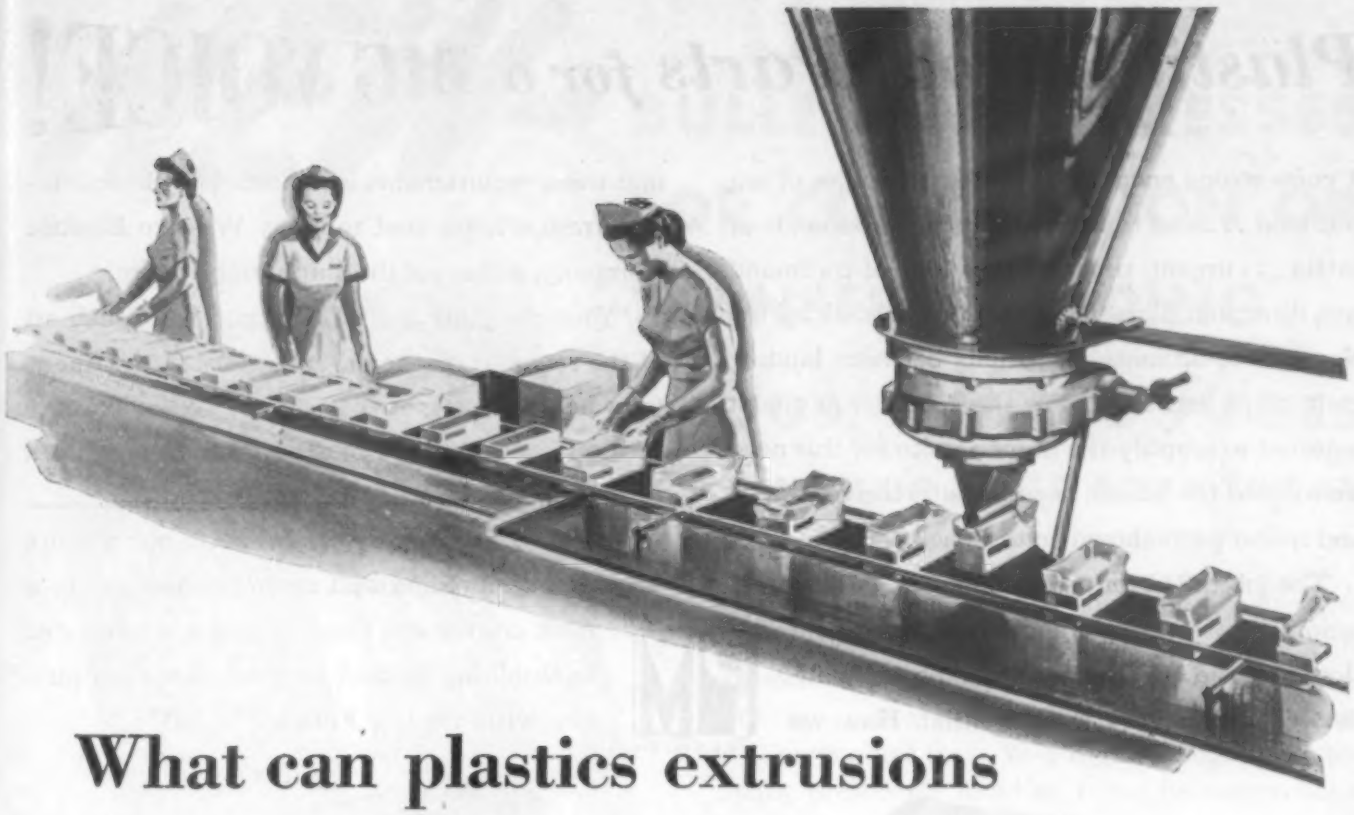
- **for making quick and accurate small-scale pressing tests.**
- **for development, research and instruction work.**
- **for testing single cavity molds.**
- **for preparation of samples.**
- **and even for small-scale production.**

Original in design, the Carver Laboratory Press is small, compact,

- **has a pressing capacity of 20,000 lbs.**
- **weighs only 125 lbs.**
- **operates under self-contained hydraulic unit, giving any precise variations in pressure that may be desired.**
- **large accurate gauge of finest construction is rigidly mounted on base.**
- **special gauges are available for low pressure work.**

Carver Press accessories include electric and steam hot plates and test cylinders or molds. Also standard interchangeable accessories are available for general research—cage equipment, bearing plates, filtering equipment, etc. The press and certain of the accessories are patented. Send now for latest catalog. PROMPT DELIVERIES FROM STOCK.

FRED S. CARVER
HYDRAULIC EQUIPMENT
343 HUDSON ST., NEW YORK 14



What can plastics extrusions do for a food processing plant

(What can they do for you?)

OUR mail ceases to surprise us!

Hardly a day goes by but some *different* industry writes us about the methods of extruding plastics for his particular business.

Typical is a recent letter from a food processing plant whose name and products we keep confidential, of course, just as we would *your* inquiry.

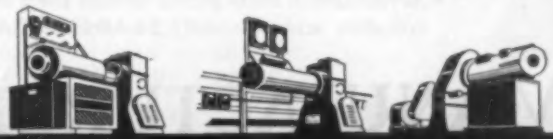
Why is this company interested in plastic extrusion machinery?

Well, their postwar plans may very well call for *improved containers* for their products. Perhaps a more attractive and durable container; produced more economically, sealed to preserve freshness, will give this company an advantage over their competition.

Although their use of plastics extrusions may be of no particular interest to you, the *process* and the possible *products* of this continuous, simplified production method can offer *you* one or more worthwhile advantages.

Look at the illustration to the right, note the wide variety of shapes and forms . . . *tiny monofilaments, thin wall tubing, sheets, rigid bars, flexible rods,* produced by this versatile method . . . then you will gain some idea of why so many industries are investigating the possibilities of plastics extrusions for their business.

So if you are looking for a simple, fast, economical method of producing plastics . . . if there's a possibility that extruded plastic parts can add the attractiveness of color or transparency to your product . . . if extruded plastics can improve the manufacture, use or operation of your products . . . then write America's leading producer of plastics extrusion machinery for further information.



NATIONAL RUBBER MACHINERY CO.
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Plastics
MACHINERY DIVISION

Plastic Throat Parts for a BIG VOICE!

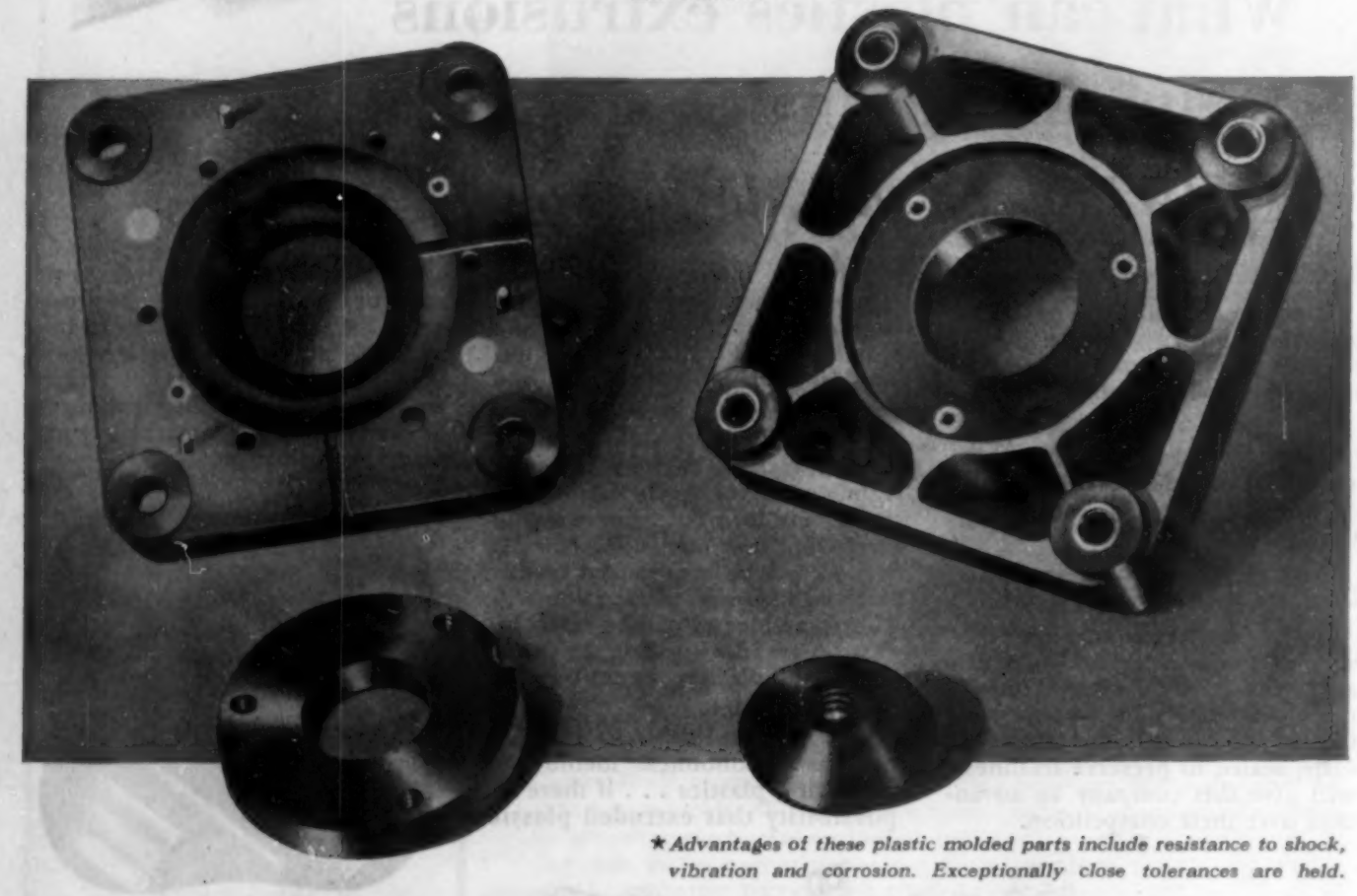
A voice strong enough to carry across miles of sea and land . . . and to be heard above the sounds of battle . . . urgent, time-saving words of command and direction. This was the voice needed by the Navy to co-ordinate operations between landing craft, ships and shore. For the special equipment required to amplify the human voice for this need we molded the plastic horn throat, receiver, insert and spacer parts shown on this page.

The job called for precise molding and incorporation of inserts. Tolerances had to be held close to avoid affecting sound and tone qualities. Quick delivery was essential. How we met these requirements is indicated by this quotation from a letter sent to us by Western Electric Company, makers of the amplifying system:

"Your company was called upon to furnish all of the required plastic parts. We feel that without your help the program could not have been a success, and we would like to express our appreciation of your fine work and excellent cooperation."

We have collected information on our plastics engineering, molding and assembly services in a most convenient form. If you are interested in obtaining product improvement thru plastics, write for free Folder File MP 5.

PM
REG. U.S. PAT. OFF.



★ *Advantages of these plastic molded parts include resistance to shock, vibration and corrosion. Exceptionally close tolerances are held.*

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MOLD MAKING • INJECTION & TRANSFER MOLDING • COMPLETE ASSEMBLY

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NEW— BULLETIN ON PRESSES FOR COMPRESSION OR TRANSFER MOLDING...

Just off the Press

SEND FOR YOUR COPY TODAY

W-S Semi-Automatic Compression Molding Press. Can be supplied with or without top cylinder for use in molding by transfer method.

HERE is a full line of standard presses to select from which will meet your molding needs—for diversified short runs or large scale production—for capacities as low as 50 tons or up to 1200 tons.

You can use these W-S high-speed, semi-automatic presses for molding either by compression or the transfer method. They are arranged and machined so that top transfer cylinder can be attached later, when desired, or they will be supplied with cylinder attached.

Bulletin 640-A fully describes presses with self-contained power unit and top cylinder and gives specifications, and dimensions of nine capacities ranging from 50 tons to 1200 tons.

In this full line of presses you should have the answer to your molding problems. At least... the bulletin will give you valuable data. Write for a copy now. The Watson-Stillman Company, Roselle, New Jersey.

7551

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HYDRAULIC MACHINERY DIVISION

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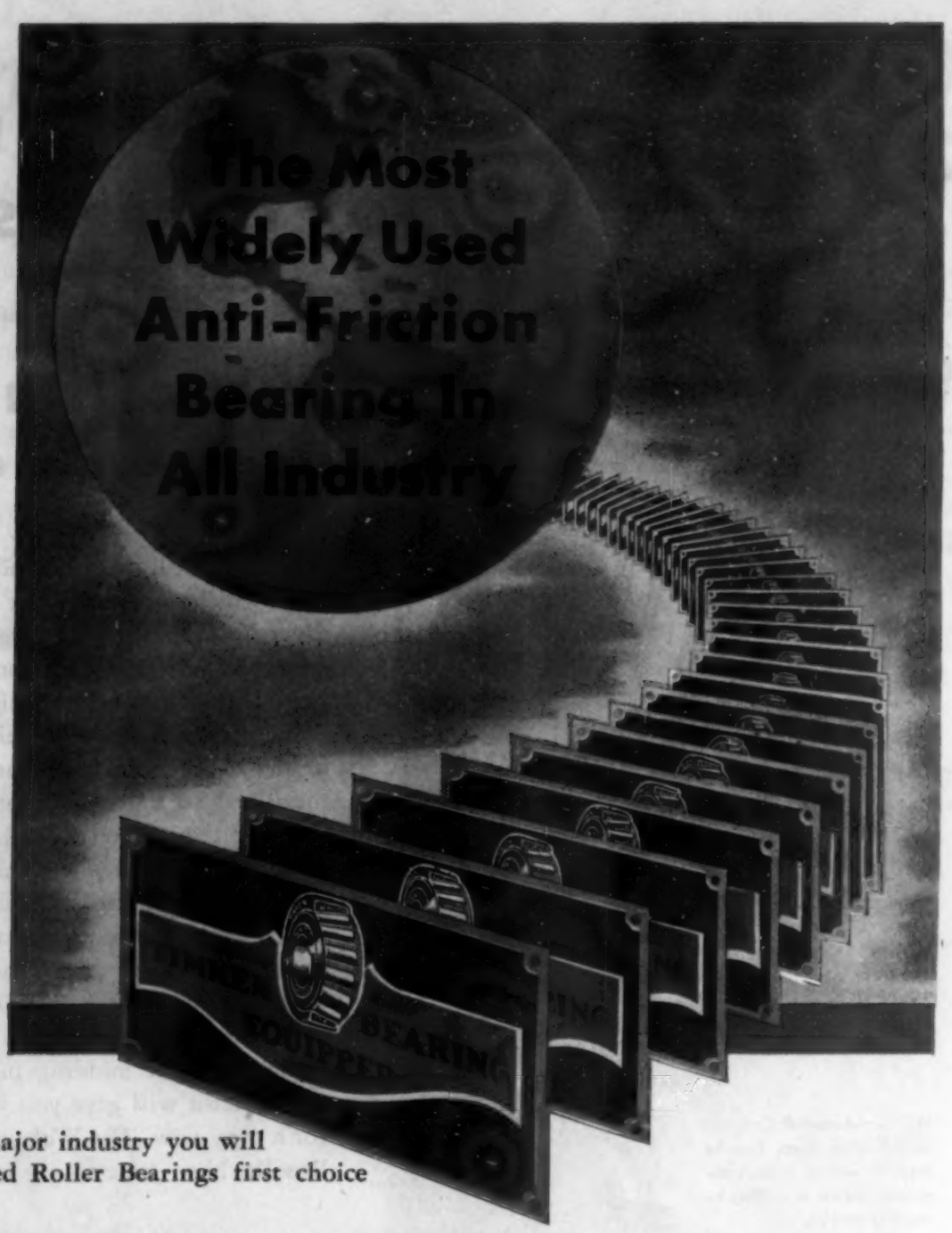


In virtually every major industry you will find Timken Tapered Roller Bearings first choice of engineers.

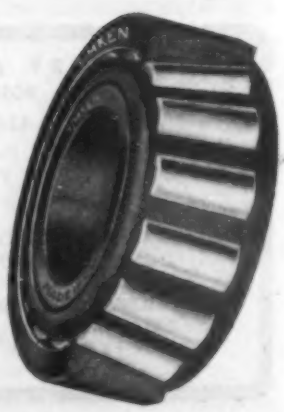
In gigantic steel mills — machine tools — motor cars and motor trucks — in paper making and in road building equipment — in countless types of war material, Timken Bearings are delivering amazing performance.

Such widespread acceptance is based simply and solely on the unexcelled service that Timken Bearings have given for nearly 50 years.

Our many years of research — our wide practical knowledge — plus Timken Alloy Steels and our unequalled manufacturing resources, are the basic reasons for the unfailing dependability of Timken Roller Bearings.

See that the trade-mark "TIMKEN" is on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio.

"All there is in Bearings"



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TAPERED ROLLER BEARINGS

Timken Bearings, Timken Alloy Steels and Tubing and Timken Removable Rock Bits

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This Fisher-Milligan gas washer is another excellent example of how the application of plastics can improve a product's functional design.

The efficiency and convenience of this gas washer has been greatly increased by substituting a self-sealing, resilient, chemically resistant Saran plastic cap for the customarily used pair of glass tubes inserted through a rubber stopper.

Mills' engineers will be glad to help you determine the possibilities of improving your product through the use of plastics. They will give your product a detailed analysis, and if plastics are advisable, will suggest which thermoplastic material and molding process will best serve your purpose.

It can make a profitable difference to your sales and production economy for you to take advantage of this service. We welcome your inquiries.

ELMER E. MILLS CORPORATION

Molders of Tenite, Lumarith, Plastacele, Fibestos, Lucite, Crystallite, Polystyrene, Styron, Lustron, Vinylite, Loalin, Mills-Plastic, Saran and Other Thermoplastic Materials

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Write on your letterhead for the new Injection Molded and Extruded Plastics catalog. Or, for detailed information about MILLS-PLASTIC* pipe, tubing and fittings, write for circulars containing data and illustrations.

*Trade Mark Reg.

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HIGH ABSORBENCY . . . PLUS STRENGTH

Precision-Made Resin Impregnating and Coating Base Stocks with UNIFORM Density Formation Caliper

High strength papers usually are difficult to impregnate thoroughly. Papers easy to impregnate often do not have the desired strength before or after being laminated.

To combine these two properties – strength plus absorbency – has been an objective of The Munising Paper Company. We make no claims of having the final answer. We do believe we have made appreciable progress.

If a high degree of rapid saturation without the customary loss of strength is of interest to your company, may we suggest you contact us.

The Munising Paper Company

Sales and Executive Offices • 135 South La Salle Street, Chicago 3, Illinois • Pulp and Paper Mills at Munising, Michigan

MUNISING PAPER

◆ MANUFACTURERS OF PRECISION MADE PULP AND PAPERS FOR MORE THAN 40 YEARS

25

25th Anniversary in Plastics

★ ★ ★

The plastics industry has grown up in the last twenty-five years. It has been our privilege to play an active part in this progress and to be associated with men who helped to build the industry. We are grateful for the opportunities we have had to contribute to the technical development of plastics. And we have appreciated being able to serve our customers with molded parts.

We hope to continue these associations and developments.

DI

Diemolding Corporation

Molders of Fine Plastics Since 1920

Canastota New York

25

Designing • Engineering • Production • Finishing

FINISHING

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TUMBLING
BUFFING
MACHINING
MARKING
ASSEMBLY
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SHIPPING

Our extensive plant facilities plus varied experience with all types of moldings . . . compression, injections and transfer . . . are your assurance that your plastic, part or product will be carefully and accurately finished at UNIVERSAL. From Designing to Finishing every operation is under our control and under our own roof.

UNIVERSAL

PLASTICS CORPORATION

NEW BRUNSWICK • NEW JERSEY

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June & Company . . . . . 719 New Center Building, Detroit 1, Michigan

BEAUTY DRAWS THE CROWDS!

Now any color is practical —anywhere—with washable VELON*

MAKE no concession to grease or grime, to tough wear or rough handling, to scuffing or scraping, to sun or rain, to salt spray or immersion, to acids, or alkalis, to soil or stain, to wear or strain of any kind.

Just remember, for your product, that tomorrow's greatest sales appeal will be color. And that with *Velon*, Firestone's new wonder fabric, any color is practical, anywhere.

So let yourself go. Be daring with pale pastels, delicate creamy tints, rich deep-glowing jewel tones. *Velon* can always be made clean, fresh, bright and colorful as new at a mere wipe with a damp cloth or cleaning fluid.

Be daring with combinations, patterns, effects. *Velon* can be produced, to your specification, in an unending variety of designs, weaves and textures.

Be daring with *Velon*—whether your product must serve indoors or out, no matter how heavy the traffic it must bear. As screening it has withstood the damp and heat of tropic jungles, protecting our fighting men from insects in the South Pacific. As upholstery fabric, it has borne up under more than three years of gruelling use in hundreds of public vehicles without loss of color or luster, without bag or stretch, or sign of wear.

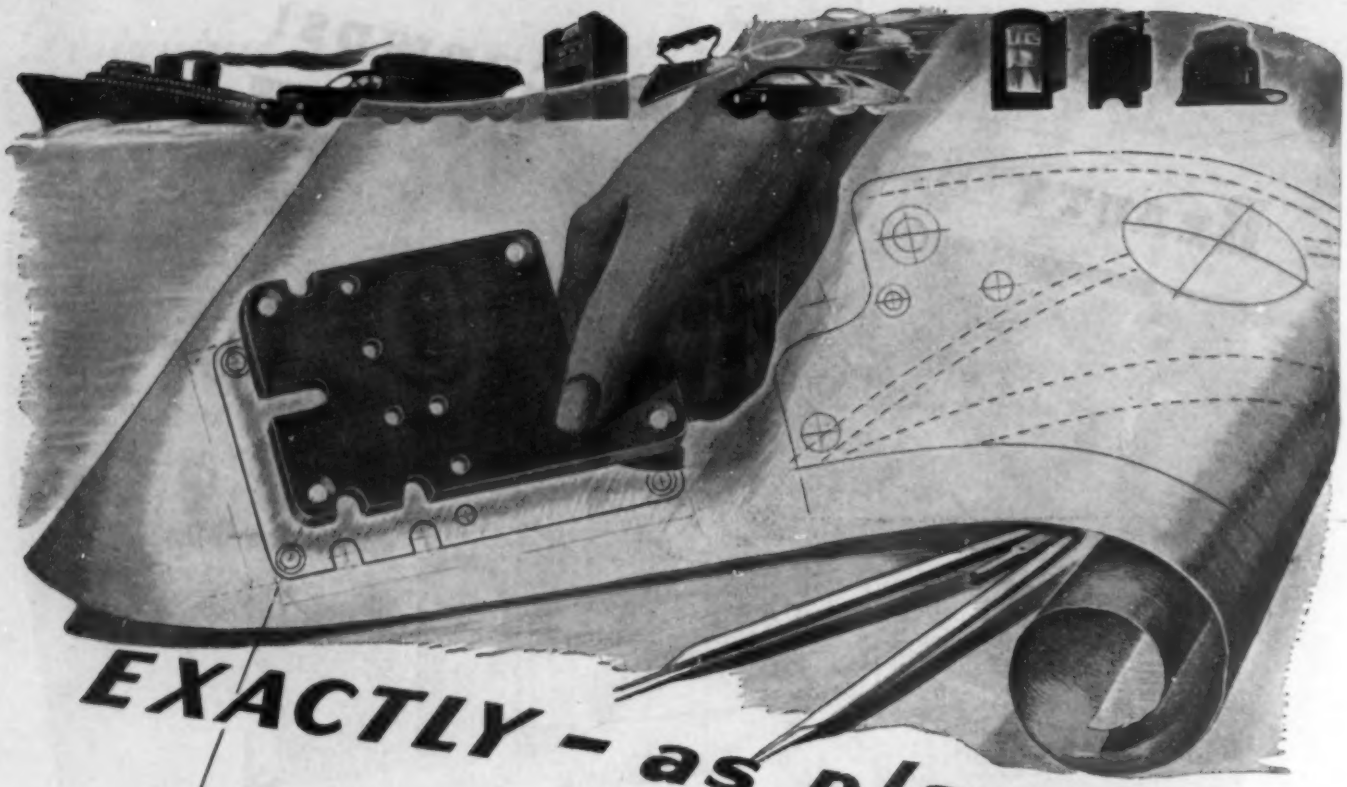
Most *Velon* now made goes to our armed forces. But for postwar remember, when it comes to color—*Velon* will be the answer!

BEST TODAY... STILL BETTER TOMORROW

LISTEN TO THE VOICE OF FIRESTONE MONDAY EVENINGS OVER NBC

ANOTHER CONTRIBUTION TO A BETTER WAY OF LIFE by **Firestone**

*Trademark pronounced VEL-LÓN



EXACTLY – as planned

This DILECTO Gr. "L" part was punched from sheet, drilled and counterbored. It is an electrical insulating part for an Army Tank. It must stand up under severe mechanical abuse.

CONTINENTAL-DIAMOND can supply you with fabricated plastic, vulcanized fibre, or mica parts EXACTLY to your blueprints . . . whether your requirements be a few pieces or a million pieces. C-D NON-metallics are especially adaptable to close tolerance fabricating; where close tolerances are needed.

Before designing NON-metallic parts to close tolerances, consult our design engineers. Their experience in helping design thousands of fabricated parts will save you money and time, by helping you avoid specifications which are beyond the possibilities of NON-metallics.

Booklet FP—"The design and fabrication of plastics and vulcanized fibre," should be on the desk of every one of your design engineers and draftsmen. We'll be glad to send you as many as you need.

KD-45

C-D PRODUCTS

The Plastics

DILECTO—A Laminated Phenolic.
CELORON—A Molded Phenolic.
DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.
HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE
VULCOID—Resin Impregnated Vulcanized Fibre.
MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

Descriptive Literature

Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

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Continental-Diamond FIBRE COMPANY

Established 1895. . Manufacturers of Laminated Plastics since 1911—NEWARK 28 • DELAWARE

There's Something about a Red Head!

MODEL 28X0

Ring mountings, made of high impact material. Rejections averaged 30% with conventional molding. When preforms were heated with Thermex RED HEAD model 185X rejections averaged only 10% and the production rate immediately climbed 100%. Savings in scrap and increased output totalled $252 daily per unit.

Preparatory to molding distributor caps, operator removes uniformly plasticized preforms, 3 OD by ⅛ thick, from 28X0 Thermex unit. High Frequency Heat went on when he closed the drawer, stopped when required temperature was reached. He has no manual tuning to do—not even a starter button to push.

There's something about a Red Head—especially when it comes to speeding up plastics production. For most molding operations, one of those red-topped Thermex high frequency heating units will double the output by cutting down molding time cycles at least 50%. The material is properly preheated and plasticized usually in seconds. Because Thermex high frequency energy heats uniformly, throughout the mass of the material, there also is a marked reduction in the number of flaws and consequent rejects. Mail the coupon.

Thermex

A GIRDLER PRODUCT **RED HEAD**

THE FIRST INDUSTRIAL HIGH FREQUENCY DIELECTRIC HEATING EQUIPMENT

THE GIRDLER CORPORATION, Dept. MP-5, Thermex Division, Louisville 1, Ky.
Please send performance and application data about the complete line of Thermex RED HEADS.

Name .....

Firm Name and Address .....

.....

GLYCERINE, Essential War Worker, Now Available to You!

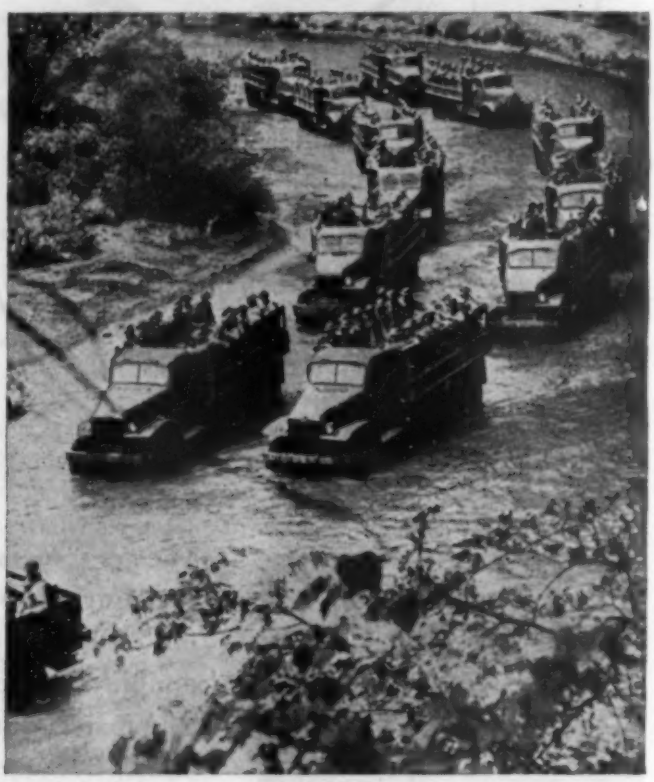
GLYCERINE, the versatile ingredient, has hundreds of war uses. It's important in the making of many medicines, foods and food products, packaging materials, textiles, vitamins, lubricants, as well as a vital chemical in the making of many explosives, plastics, surface coatings, and other materials.

The Surgeon General's Office, the Medical Corps, and other important governmental agencies recognize the need of using glycerine in many applications where human life is concerned. Another reason why war demands upon glycerine are huge.

But now there is glycerine for the production of civilian goods, also! If you are using emergency war substitutes, you'll want to get back to safe, time-tested glycerine. And when you plan new products, you'll want to use glycerine, too. Send for the free booklet, "Nothing Takes the Place of Glycerine — 1583 Ways to Use It." Address: Glycerine Producers' Association, 295 Madison Avenue, New York 17, N. Y. Dept. J-6.

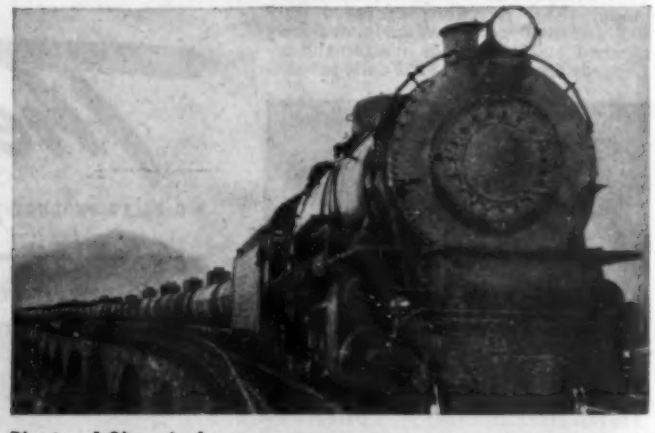
Wholesome Eating! Glycerine is a time-tested ingredient of candies, cellophane food wrappings and casings, flavorings, colorings, tobaccos, and other products used by humans. Use glycerine!

Glycerine, the Healer. Glycerine, important in many explosives, is just as important in many medicines. It has been proved by generations of use. Use wholesome glycerine in your pharmaceuticals!



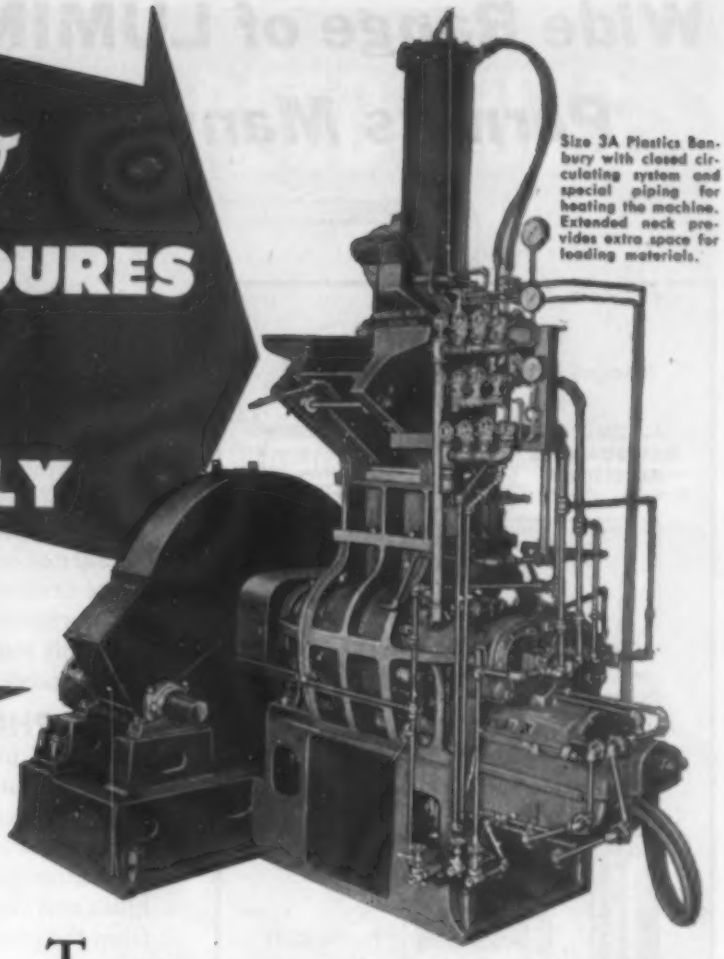
Better Paints! Alkyd resins, used to make long-lasting paints for war equipment, mean better paints for peace. Glycerine is a prime raw material in alkyd resin manufacture.

Safe in Cosmetics! Glycerine, important part of many protective lotions and ointments used by military men in the field, can help you make sought-after cosmetics. Use glycerine—*and be sure!*

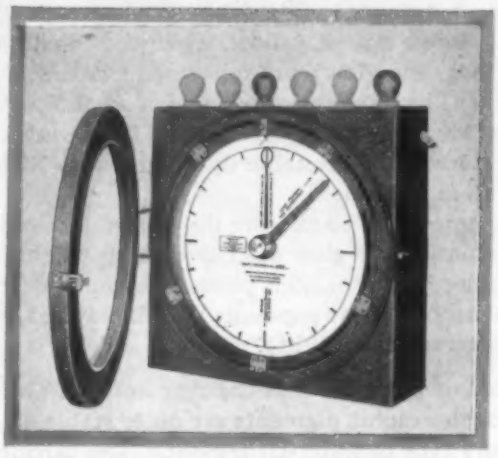


Plenty of Glycerine! If you have been using emergency substitutes, you'll want to get back to safe, time-tested glycerine. And you'll want to use glycerine in your new products, too!

Here's how MIXING PROCEDURES CAN BE AUTOMATICALLY CONTROLLED

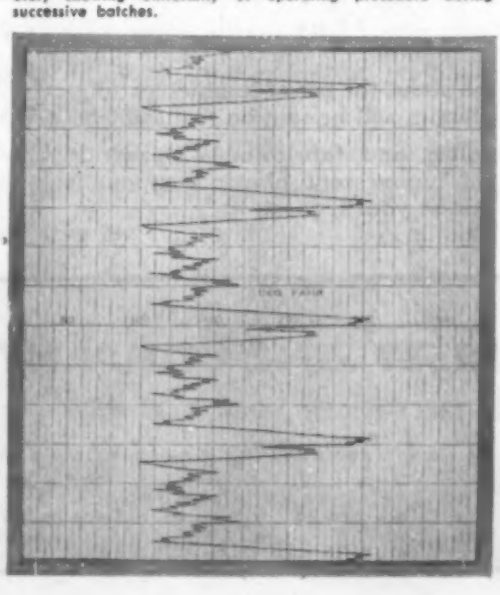


Size 3A Plastics Banbury with closed circulating system and special piping for heating the machine. Extended neck provides extra space for loading materials.



Timing device with typical instruction chart. Door opened to show contactors which flash signal lamps at any selected stage of mixing cycle.

Section of strip chart from recording potentiometer pyrometer, showing uniformity of operating procedure during successive batches.



The elimination of expensive and variable hand operations—*the transfer of skill to mechanism*—is probably one of the greatest services performed for industry by the Banbury Mixer. By use of the devices described below, each operation in the mixing procedure can be automatically controlled—and recorded. All guess work is eliminated . . . dependence on the operator's judgment becomes unnecessary.

TIMING DEVICE

A telechron-motor-operated timing instrument is supplied with all production size Banburys. Its removable paper dials, or charts, are graduated by minutes for marking just how long to allow for each operation. Contact arms, set to correspond with the instructions on the dial, close a circuit as each stage of the operating cycle is completed, signalling the operator automatically by flashing one of a series of lamps on top of the instrument. At the completion of each batch, the pointer can be returned to zero and the procedure repeated; when the formula is changed, a new chart can be inserted.

TEMPERATURE RECORDER

When the deciding factor in a mixing process is temperature, the electrically actuated recording potentiometer pyrometer, supplied with each production Banbury, can be used to control the operation of the mixer, automatically discharging the batch when a predetermined maximum temperature has been reached. This is an important advantage in mixing sensitive products which have a definite temperature limit.

AUTOMATIC DISCHARGE CONTROL

Optional equipment includes an automatic discharge control, operated either by the timing device or the temperature control. The mechanism automatically opens the door and keeps it open long enough for complete discharge of the batch.

For further details of these and other features of the latest Banbury Mixers, write for a copy of NEW, 32-page bulletin No. 180. No cost . . . no obligation.

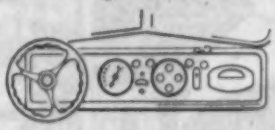
FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.
Plants: Ansonia and Derby, Conn., Buffalo, N. Y. Sales Offices: Ansonia, Buffalo, New York, Pittsburgh, Akron, Los Angeles.

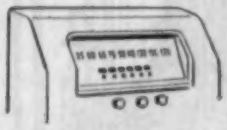
Farrel-Birmingham

Wide Range of LUMINESCENT Colors Permits Many and Varied Applications

FLUORESCENT
(Excited by "black" light exposure)

AUTOMOTIVE DASHBOARDS & ACCESSORIES





RADIO DIALS, NAME PLATES & DECORATION

Aviation dials and accessories
Decorative effects

Displays and advertising
Light diffusers
Theatrical effects

PHOSPHORESCENT
(Excited by any light exposure)

NAME PLATES

CLOCK AND WATCH FACES

FLASHLIGHTS

EXIT

SIGNS

- Apparel accessories
- Architectural trim
- Automotive accessories
- Cord pull (light and window shades)
- Decorative effects
- Displays and fixtures
- Door knobs and kick plates
- Electric switch plates, fixtures and equipment
- Escutcheons and medallions
- Fish lures
- Games
- Household items
- Jewelry
- "Juke" boxes
- Light diffusers
- Marking tapes
- Product packages and labels
- Slipper tips
- Tools

FLUORESCENT PIGMENTS are available in a wide range of fluorescent colors, covering the visible spectrum from blue to red, and include a bluish white. Generally, the daylight color differs from the fluorescent color but the daylight color may be modified to a limited degree, when desired, by the inclusion of very small amounts of soluble dyes, with little effect on the fluorescent brightness. Inorganic pigments generally should not be used, as pigments of non-fluorescent type tend to dilute or mask the brightness of the fluorescent color.

Fluorescent pigments are the type of luminescent pigments that emit visible light only during the time they are exposed to the excitation of a near-ultraviolet (black) light.

PHOSPHORESCENT PIGMENTS are available in a range of phosphorescent colors from blue to orange yellow. The zinc sulfide (short-afterglow) phosphorescent colors are two greens, the zinc-cadmium sulfide (also short-afterglow) phosphorescent color is an orange yellow, while the calcium-strontium sulfide (long-afterglow) phosphorescent colors are blues and blue-greens. The daylight colors, which are different from the phosphorescent colors, may be modified by the inclusion of a very small amount of suitable dyes, with very little effect on the luminescent brightness.

Phosphorescent pigments, of course, are the type of luminescent pigments that continue to glow after the exciting light is extinguished. When used only for their phosphorescent (afterglow) properties, phosphorescent pigments may be excited by any light source (visible, or black light).

BOTH the fluorescent pigments and the zinc and cadmium sulfide types of phosphorescent pigments are quite stable, and may be used with any type of water-clear plastic. The calcium and strontium sulfide types of phosphorescent pigments, however, are sensitive to moisture and acid conditions. The latter should be used with plastics that possess good resistance to water and moisture.

More information about the use of luminescent pigments in your plastics will be sent on request.

Molders, laminators and fabricators — Names of manufacturers of luminescent plastic compounds will be sent to you at your request.

THE NEW JERSEY ZINC COMPANY
160 FRONT STREET • NEW YORK 7, N. Y.
Products Distributed by THE NEW JERSEY ZINC SALES COMPANY
NEW YORK • CHICAGO • CLEVELAND • SAN FRANCISCO

MULTIPLE AND TWIN SPEED NUTS

Combine FASTENERS INTO ONE UNIT!

Illustration shows use of Twin SPEED NUT for attaching bracket to aircraft fuselage frame. Applied faster, reduces number of parts, and prevents vibration loosening.

Four Multiple SPEED NUTS are used on Tappan Stove's food warmers, now standard equipment on the B-29 Super Fortress. Only 10 rivets necessary to hold all 4 SPEED NUT strips for blind attachment of liner to cabinet.

Individual SPEED NUTS offer tremendous advantages over ordinary fasteners, but Twin and Multiple SPEED NUTS go even further. They COMBINE two or more SPEED NUTS into one unit to simplify, reinforce and speed up multiple fastening attachments.

Twin type SPEED NUTS are available with ½" to 1" hole spacings, for machine screws or sheet metal screws. Center hole in SPEED NUT permits riveting in place for blind location assembly.

Multiple type SPEED NUTS are available with 1" to 2" hole spacings, for 6Z, 8Z or 10Z sheet metal screws. Supplied in any desired lengths or in coils. Made of spring steel for riveting in blind location, or stainless steel for welding. In writing for samples, please give screw size and hole spacing.

TINNERMAN PRODUCTS, INC.
2048 FULTON ROAD, CLEVELAND 13, OHIO
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In England: Simmonds Aerocessories, Ltd., London

Speed Nuts PATENTED *Trade Mark Reg. U. S. Pat. Off.
FASTEST THING IN FASTENINGS

THE BASIC PRINCIPLE
of Spring-Tension Lock is
Embodied in all Speed Nut Designs

BECAUSE this worker is using *The right file for the job,* both proper finish and maximum production are attained.

For smoothing the edges of plastic propeller blades, she uses a Nicholson Double End Button File. With its single or "mill" type teeth cut from both ends toward the middle, the file is sure to be ready for use no matter which end is grasped. Good balance enables the file to be handled deftly and speedily.

The variety of plastics products, plus the variety of plastic *materials* or compositions, has become so great that the range of files—for flash removal, finishing and parts fitting—has become correspondingly wide.

Intricate parts, with all sorts of edges, angles, slots, grooves and holes, mean variety in the *shapes* of files. Hard, soft, shreddy materials, and laminated stocks, bring out the need for special *cuts* of files . . . sharp, high-topped teeth, for instance, on highly abrasive compositions; wide-gulleted teeth to facilitate clearing where materials have a tendency to clog.

Nicholson service engineers will be glad to give molders and fabricators the benefit of their studies of plastics files and filing. What are your problems?

NICHOLSON FILE CO. • 44 ACORN STREET, PROVIDENCE 1, RHODE ISLAND

(In Canada, Port Hope, Ont.)

NICHOLSON FILES FOR EVERY PURPOSE NICHOLSON U.S.A. MADE IN U. S. A.

Sir Hubert's armor was rugged enough—but gosh, so heavy! In his day, strength and lightness were unheard of combinations. But they're yours now in KYS-ITE—*plus* other features seldom found together.

Below you'll see what KYS-ITE has to offer. All backed by the wealth of experience that Keyes Service Department brings to every plastics problem.

GREAT STRENGTH WITH LIGHT WEIGHT

Preformed before curing, an even distribution of phenolic resin on interlocking fibres results in great tensile and compressive strength with an impact strength 4 to 5 times that of ordinary plastics.

WIDE RANGE OF SHAPES

Complicated pieces with projections and depressions, large or small shapes and sections—all these and more too. are molded successfully in KYS-ITE.

KYS-ITE CAN "TAKE IT"

Unusually durable and resistant to abrasion, impervious to mild alkali and acid solutions.

INTEGRAL COLOR AND FINISH

KYS-ITE's lustrous finish is highly durable; the color is an integral part of the material itself.

NON-CONDUCTOR

KYS-ITE's dielectric properties make it invaluable where safety is a factor. Also a non-conductor of heat. Non-resonant and non-reverberating.

WHAT CAN WE DO FOR YOU?

Our service includes discussion of your ideas and requirements. We mold to your specifications, sending you the wanted item in completed form. If we can't fill your needs in KYS-ITE, we'll suggest other companies to contact. Production now being scheduled as orders arrive. May we expect your inquiry soon?

Buy War Bonds—and Keep Them

KEYES FIBRE COMPANY
420 Lexington Avenue
New York 17, New York
Plant at Waterville, Maine

KEYES
MOLDED PRODUCTS

KYS-ITE articles indicating the range of items we mold to specifications and deliver complete, ready for use.

The Long-Fibred Wood Pulp Filled Phenolic KYS-ITE Resin Plastic Pre-formed Before Curing

Reg. U. S. Pat. Off.

Fiberglas*-Reinforced Plastics Laminates Establish new HIGHS in Impact Strength

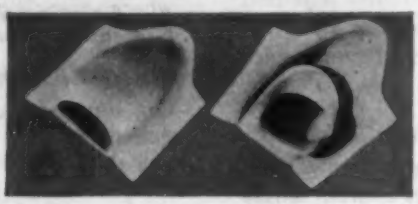
Make it stronger! Make it lighter!—these ever-present aircraft industry specifications have resulted in many improvements and new materials.

One of the developments which is solving numerous current problems and which holds great future promise is Fiberglas-reinforced plastics laminates.

Impact strength from five to ten times that previously obtained in laminates—is now available through the use of Fiberglas cloth woven from fine, strong yarns of glass, having a tensile strength beyond that of steel.

Glass fibers have great flexibility and stand high stresses without permanent deformation. This combination of properties gives extremely high impact strength to laminates reinforced with Fiberglas fabrics.

Fiberglas-reinforced plastics sheets, used as a protective lining for bomber fuel cells, do not "flower" when the fuel cell is struck by a bullet or shell fragment.



This aircraft air scoop is an excellent example of a formed part made of Fiberglas cloth and low-pressure resins. Larger structural shapes and dies, jigs and fixtures are now being made of the same materials.

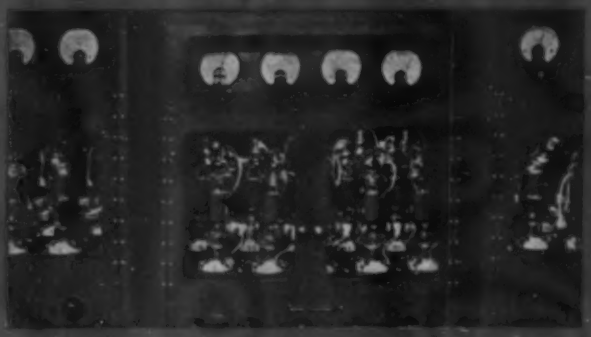
Impact strength, tensile strength and other characteristics of the laminates, of course, vary according to the amounts and type of Fiberglas that is used as well as the type of resin used. However, experience and extensive investigations have proved that higher impact strength can be attained by the use of Fiberglas reinforcement than can be reached when other reinforcing materials are used.

Samples and complete information on Fiberglas Textiles will be sent to you on request. Owens-Corning Fiberglas Corporation does not manufacture resins or finished laminates but will be glad to furnish data on techniques in the use of Fiberglas in this rapidly growing industry. Write: *Owens-Corning Fiberglas Corporation, 1876 Nicholas Building, Toledo 1, Ohio. In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.*

Fiberglas textiles are made in weights and dimensions suitable for use as reinforcement in low-pressure plastics laminates.

FIBERGLAS.. *A BASIC MATERIAL*

*T. M. Reg. U. S. Pat. Off.



QST-1—Life testing is an important Quality Standard test at United. It is a strictly observed procedure whereby life expectancy is controlled in "run-of-production" tubes.

QST-2—A unique test is applied to every United tube to assure noise-free operation.

Who sets the *Quality Standard* FOR TRANSMITTING TUBES

QST-3—United tubes designed for very rough service have extra, built-in shock resistance proved by the severe Bump Test each tube must pass.

*Quality Standard Test

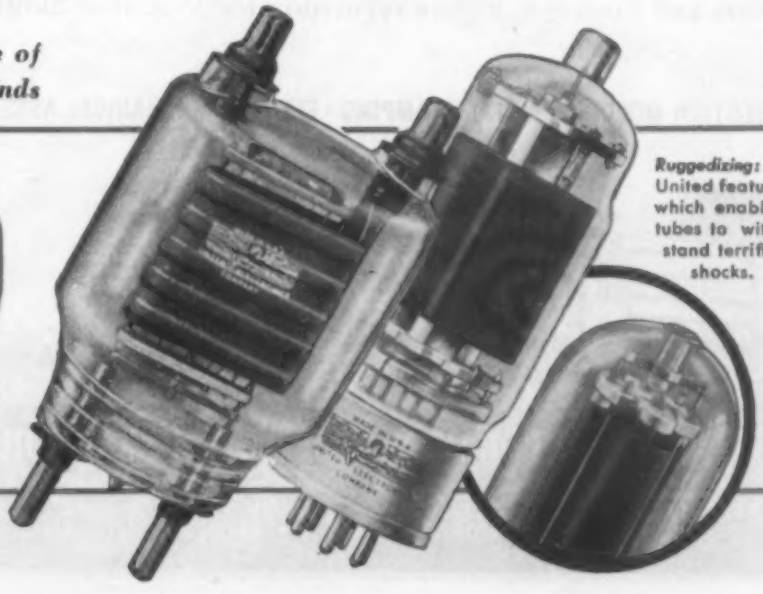
Brilliant United craftsmanship is steadfastly verified and maintained by skillful and vigilant testing—truly representative of daily production. For this reason every United tube must pass through a series of critical examinations that do not permit any defects, no matter how minute they may be, to escape unnoticed.

By maintaining Quality Standard Tests of the highest order United engineers and technicians have achieved recognition for leadership. To engineers everywhere, the name United is the *trusted* standard by which other transmitting tubes are judged and measured.

For every electronic application including radio communication, physiotherapy, industrial control and electronic heating, standardize with tubes that are *the* Quality Standard. "Tube up" with United.

Order direct or from your electronic parts jobber.

Masterpiece of Skilled Hands



Ruggedizing: A United feature which enables tubes to withstand terrific shocks.

UNITED

ELECTRONICS COMPANY

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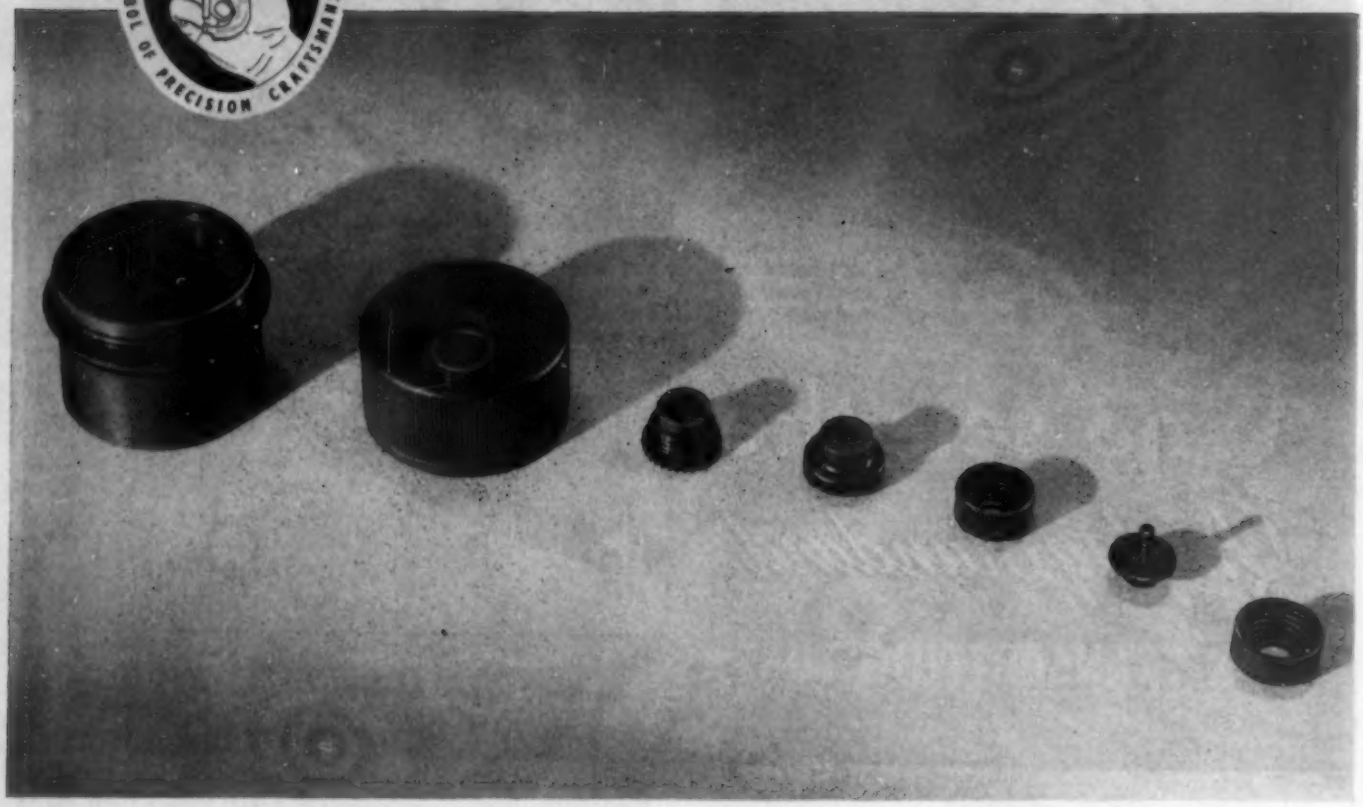
Transmitting Tubes EXCLUSIVELY Since 1934

Santay

SYMBOL OF PRECISION CRAFTSMANSHIP

PARTING LINES!!



Sure! There are parting lines on these parts. Can you see them? These parts are photographed as they actually look—no retouching has been done to the parting lines.

Fine parting lines on thermoplastic parts having external threads are a must—especially when realizing another piece is assembled or intermeshed to these threads. Fine parting lines mean real skill in making molds, but fine parting lines are the practice, not the exception, of SANTAY thermoplastic threaded parts—*Santay builds their own molds.*

When considering a source for your custom thermoplastic needs, remember fine parting lines and Santay—with the reputation for Precision Skilled Craftsmanship.

INJECTION MOLDING • METAL STAMPING • ELECTRO-MECHANICAL ASSEMBLIES

SANTAY CORPORATION 355 NORTH CRAWFORD AVE. CHICAGO 24, ILLINOIS

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CLOTH FOR ANY AND ALL USES

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TEXTILES FOR THE PLASTICS INDUSTRY

Let our Technicians help you with your post-war planning

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"An Introduction to

PLASTIN"*

CONTAINS INFORMATION ABOUT THIS SUPERIOR MOISTURE-VAPOR BARRIER

Plastin is the new heat-sealing material that surpasses all requirements for Type I barriers and permits corrosion-free shipment and storage in all conditions of atmosphere and temperature for all sizes of products, from tiny meters to huge generators. "An Introduction to Plastin" is a file-size folder which lists the characteristics of two types of Plastin. A sample of each type is included. Your request will bring you a copy of "An Introduction to Plastin" by return mail.

PLASTIC FILM CORPORATION

TELEPHONE: LEXINGTON 2-5458 • 475 FIFTH AVENUE, NEW YORK 17, N. Y.

**T. M. Reg. U. S. Pat. Off. Pat. Pending*

"LIVE" AMMUNITION THAT DOES NOT KILL
...FROM PLASTICS
Aerial gunners in training now fire real bullets at American planes flown by American pilots! But both the target plane and its pilot are safe . . . because the special bullets used in training shatter harmlessly upon impact.
The Frangible Bullet, developed by Army Ordnance, makes a major contribution to the deadly skill of our aerial fighters. MOLDED PRODUCTS CO. has been assigned the responsible job of producing these Frangible Bullets by the million. MOLDED PRODUCTS COMPANY, 4533 W. Harrison St., Chicago 24, Ill.
With the Frangible Bullet, the gunners on American bombers now learn how to shoot under actual battle conditions. Their targets are fast P-63 Kingcobra fighters, specially armored to protect the pilot. These planes are equipped with a radiosonic device which flashes a light in the propeller spinner when slugs hit the target area. Thereby the gunner in training can instantly observe and correct his aim while the "attacking" plane executes typical combat maneuvers.
PLASTICS DIVISION
MOLDED PRODUCTS

CLEAR OUT THE "Fastening Bugs" BEFORE YOU SET UP FOR PEACETIME PRODUCTS

Specify the SHORT CUT FASTENING METHOD and avoid later changes, expense, delays

Don't wait until you resume manufacture of your peacetime product to find out that needless tapping, needless inserts in plastics, or other fastening "bugs" are slowing down assemblies and running up your costs.

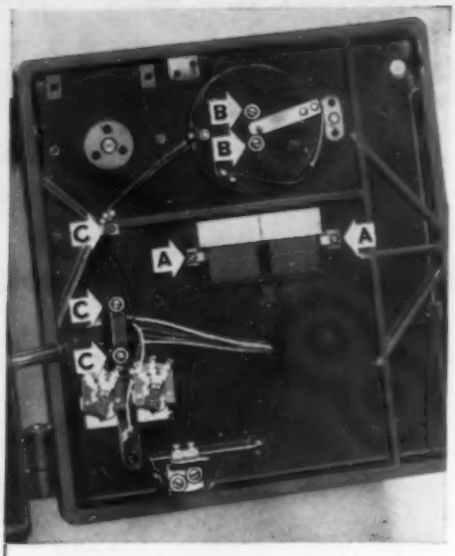
Check up *now*, while your plans are still in process. Choose fastenings as carefully as you settle any other factor of design. Make sure you are using the *short cut fastening method* – Parker-Kalon Self-tapping Screws – wherever possible.

Give your product the advantage of the 30% to 50% saving in assembly time and labor made possible by P-K Self-tapping Screws. Eliminate tapping for machine screws and tap expense – fumbling with nuts and bolts – costly inserts that slow up molding.

USER'S GUIDE – FREE! P-K "Users' Guide" describes all types of Parker-Kalon Self-tapping Screws and tells where to use them. Designers and assembly planners need this important information. Write for a copy.

ASK THIS EXPERT ON FASTENINGS

how to simplify and strengthen assemblies, how to save time and lower costs. The P-K Assembly Engineer gives you unbiased advice, because P-K makes all types of Self-tapping Screws. Ask him to call . . . or, mail assembly details for recommendations. Parker-Kalon Corp., 208 Varick Street, New York 14, N. Y.



Will "Blind Fastenings" boost your parts breakage?

Heres' how Tagliabue licked this "bug" and speeded production

Difficulty in judging hole depth, when tapping blind holes for small machine screws, resulted in taps breaking through, ruining plastic parts at Tagliabue Mfg. Co., Brooklyn, N. Y., makers of TAG pressure and temperature instruments.

Changeover to P-K Self-tapping Screws ended this trouble, stopped breakage, saved tapping time and tap expense.

P-K Type "Z" Screws are used (A) to attach steel clips fastening window to plastic door; (B) to fasten plastic rheostat disc to door; (C) to attach steel clamps holding wire to door. The screws form their own strong threads as they are turned into plain holes. One easy operation makes a fastening.

PARKER-KALON
Quality-Controlled
SELF-TAPPING SCREWS

For Every Metal and Plastic Assembly

Here's the Booklet we promised YOU!

The Story of SARA-SEAL is now ready!

THIS free booklet describes completely the principle and operation of the amazing machine which seals an almost limitless variety of products in moisture-proof, air-tight, floating bags of transparent plastic. It gives technical data on sealing methods and materials. A book for everyone interested in protective packaging. The coupon will bring your copy.

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Please send me a copy of your new Sara-Seal booklet.

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BLUE JACKETS

like their coffee hot!

On every front, on PT boats, in aircraft and in advanced bases, heavy duty Hemco Tableware is being used today because Blue Jackets like their coffee hot.

Light in weight and designed to nest efficiently, this line of plastic tableware produces as much as 90% savings in weight and cargo space.

The plant behind these products is 100% engaged in war work now. When peace comes again, Hemco high capacity compression presses will be available once more for molding standard products.

THE BRYANT ELECTRIC COMPANY

HEMCO PLASTICS DIVISION

Molders of Compression and Injection Type Plastics

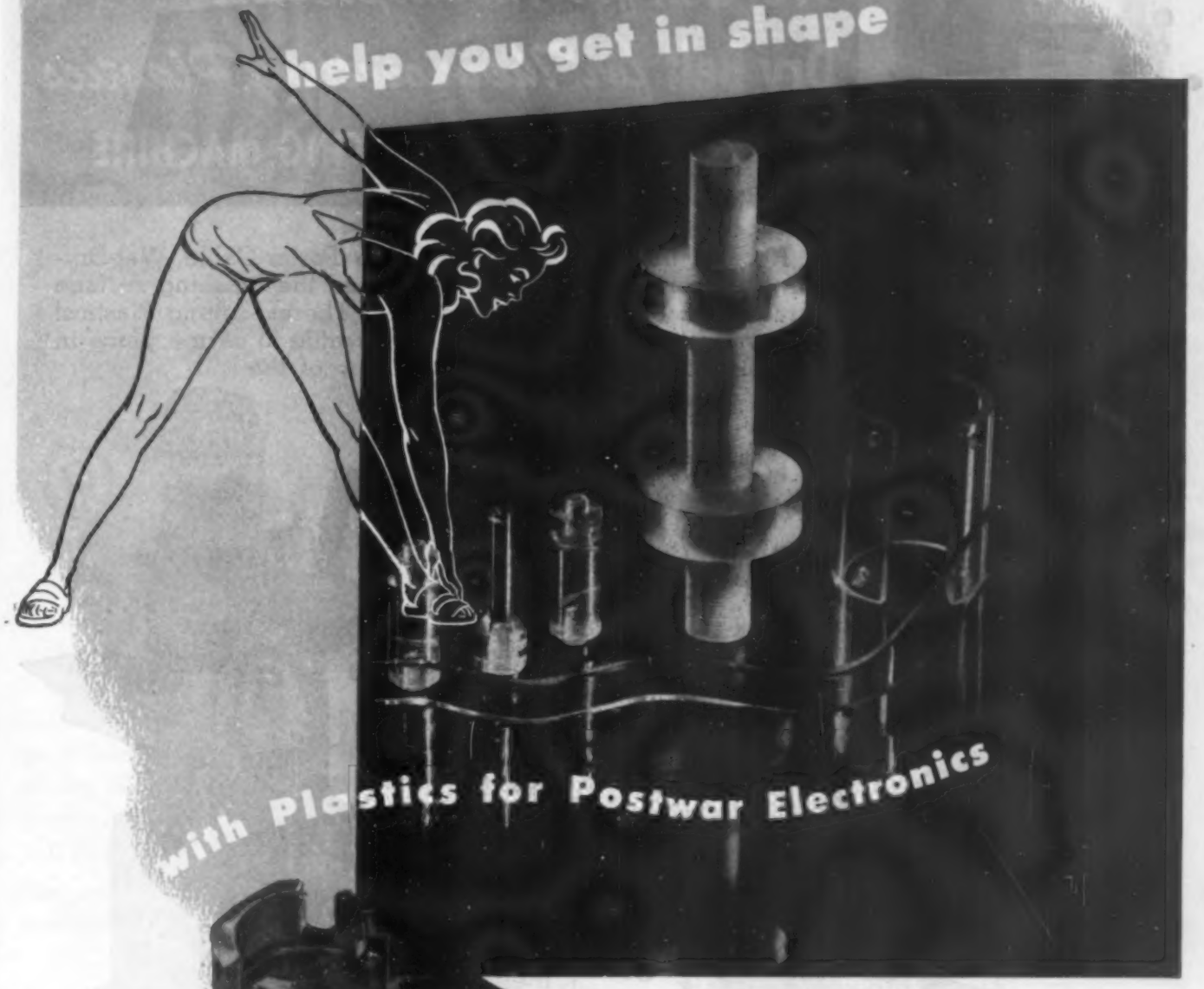
BRIDGEPORT 2, CONNECTICUT

A subsidiary of Westinghouse Electric & Manufacturing Company

HEMCO PLASTICS

Let AMPHENOL

help you get in shape



with Plastics for Postwar Electronics

What material? What shape? What characteristics? These are big questions in every design department and product engineer's mind, whenever new products are discussed. With years of experience Amphenol can answer them for the wide range of old and new type plastics applications.

Particularly in the new science of electronics are exact answers necessary . . . tolerances very close . . . production runs very large. In this highly specialized field Amphenol has enjoyed a major success—climaxed by months of war production to rigid A-N, British and U.H.F. specifications.

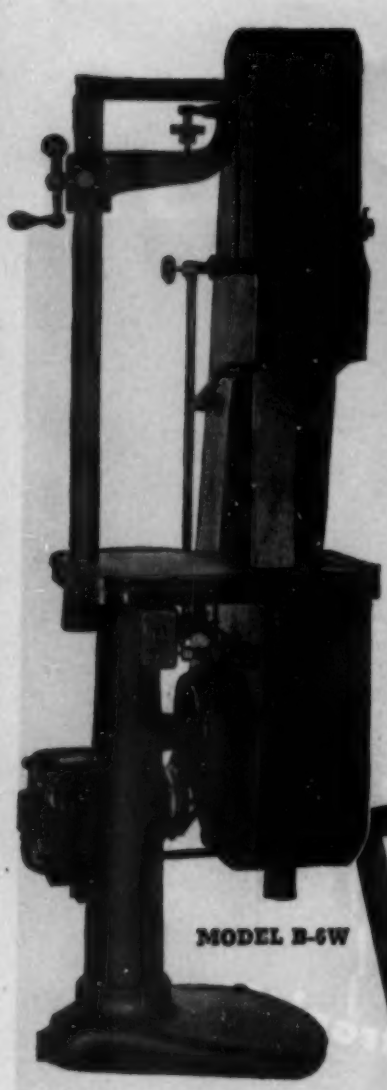
When your plans involve strict electrical characteristics, high precision or quantity production, think first of AMPHENOL and save time.

Plastics for Electronics and Industry
—Parts for Radio—U.H.F. Cable—
Connectors (A-N, British, U.H.F.)—
Conduit—Cable Assemblies

AMERICAN PHENOLIC CORPORATION
CHICAGO 50, ILLINOIS
IN CANADA • AMPHENOL LIMITED • TORONTO

Wet Belt *for Thermoplastics*
Dry Belt *for Thermosetting Plastics*
• BOTH IN ONE SURFACING MACHINE

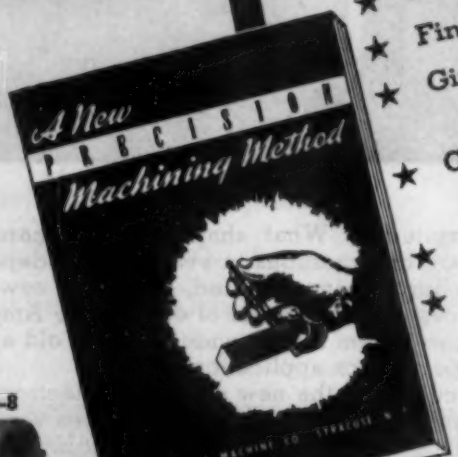
★ Here is practical versatility! The Porter-Cable Wet-Dry-Belt Surfacer combines in one machine the finishing surface required for both Thermoplastics and Thermo-setting Plastics! But a machine must be more than versatile to earn a place in the plastics industry! Here are a few of the other *production-plus* features:



MODEL B-6W

★ Eliminates flow—discoloration—warping—dust!
★ Removes gates — sprues — flash!
★ Smooths molded defects!
★ Finishes rough spots!
★ Gives all-over finish to spheres and cylinders!
★ Cuts rejects—*even with newly trained operators!*
★ Holds contour!
★ 5 to 25 TIMES FASTER THAN MANY COMMON METHODS!

MODEL WG-4



MODEL BG-8

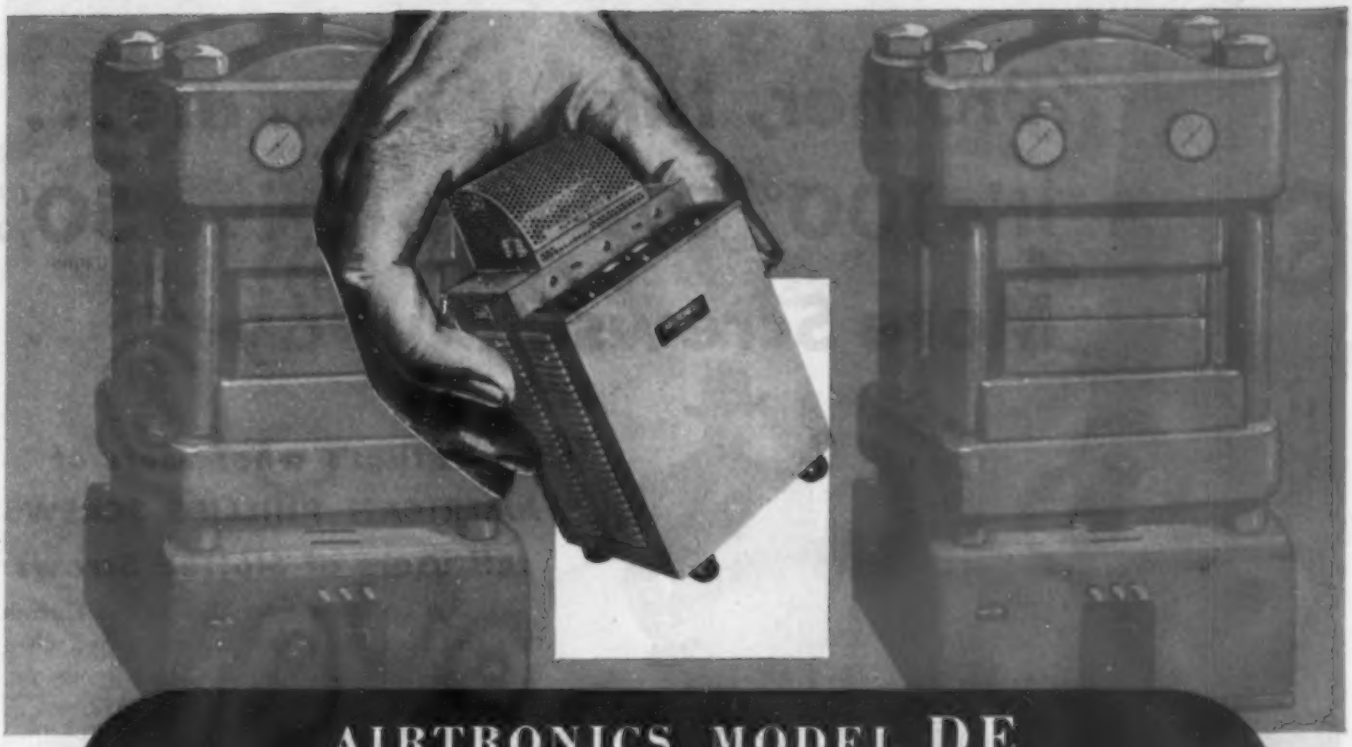
The Porter-Cable Wet-or-Dry Belt Surfacer is new in concept—simple in design—revolutionary in action! A new FREE book will bring full information.

PORTER-CABLE MACHINE CO.
1606—5 N. Salina St.
Syracuse 8, N. Y.

Please send me a copy of "A New Precision Machining Method."

Name..... Title.....

Company.....



AIRTRONICS MODEL DE PACKS MORE PREHEATING POWER INTO LESS PRODUCTION SPACE

The Airtronics Model DE delivers 2.5 KW of power, yet occupies less space than many 1 KW preheaters. Its greater power means *faster* preheating of *more* material; its smaller size means economy of floor space — important in crowded war plants where every square foot must pull its production weight.

The powerful Model DE also features such exclusive production advantages as:

- AUTOMATIC POWER REGULATION
- AUTOMATIC LOAD CIRCUIT TUNING
  — these automatic controls, working together, hold output power constant at a pre-set level regardless of variations in the characteristics of the material being preheated, and keep preheater efficiency at its highest practical value.
- DUAL LOAD SELECTION
  — which provides two independent sets of controls that can be pre-set to heat molding material for two presses running different jobs.

The Model DE's extra power gets tough jobs done... does run-of-the-shop jobs faster... and in many cases actually *doubles* preheating capacity. Send for the new four page folder describing its unique production advantages.

Model DE Plus-Features

- 2.5 KW Output Power
- Automatic Load Circuit Tuning
- Automatic Power Regulator
- Self-Positioning Electrodes
- Compact — only 36" high, 26" wide, 22" deep.
- Input Voltage Regulator
- Mobile

NOW — Faster Preheating		
MATERIAL (1 lb.)	TIME	TEMPERATURE
BM 120	42 sec.	240° F
BM 926	37 sec.	240° F
DUREZ 55	49 sec.	240° F
DUREZ 2491	48 sec.	240° F
TEXOLITE 1589	42 sec.	240° F

Airtronics MANUFACTURING CO.

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"Brother, take it from me... it's 100% Easier to Drive 50% More Screws in a Day!"

. . . that's what users of

AMERICAN PHILLIPS SCREWS

tell users of Slotted Screws

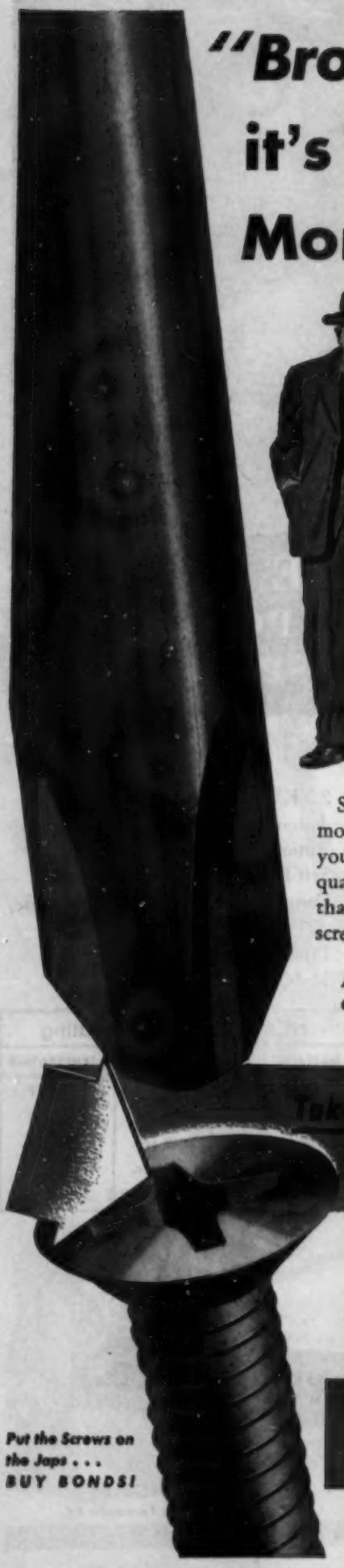
Workers on screw assemblies feel as though they had been freed from a chain gang, when their production chiefs liberate them from slow, exhausting, *high-cost* slotted screw driving . . . up to speedy, easy, *low-cost* American Phillips Screws and 4-winged Phillips power drivers.

For then they find that they can make their jobs amount to something . . . that it's actually far easier to do better work and more of it . . . yet still end their shifts without undue fatigue. Simply because American Phillips Screws drive automatically straight—and because the 4-winged driver can't jump out of the recess.

So management finds that . . . by increasing workers' safety, earning power, and morale . . . there's a fairer return on fixed overhead charges. And *you* will find, when you change to American Phillips Screws, that you get *extra* returns from American's quality-control and American's three-point inspection of head, thread, and point that assures full usable value in every shipment. Whether you use standard or special screws, you'll save 50% over slotted, by changing to American Phillips Screws. Write.

AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND

Chicago 11: **589 E. Illinois Street** ***Detroit 2:*** **502 Stephenson Building**

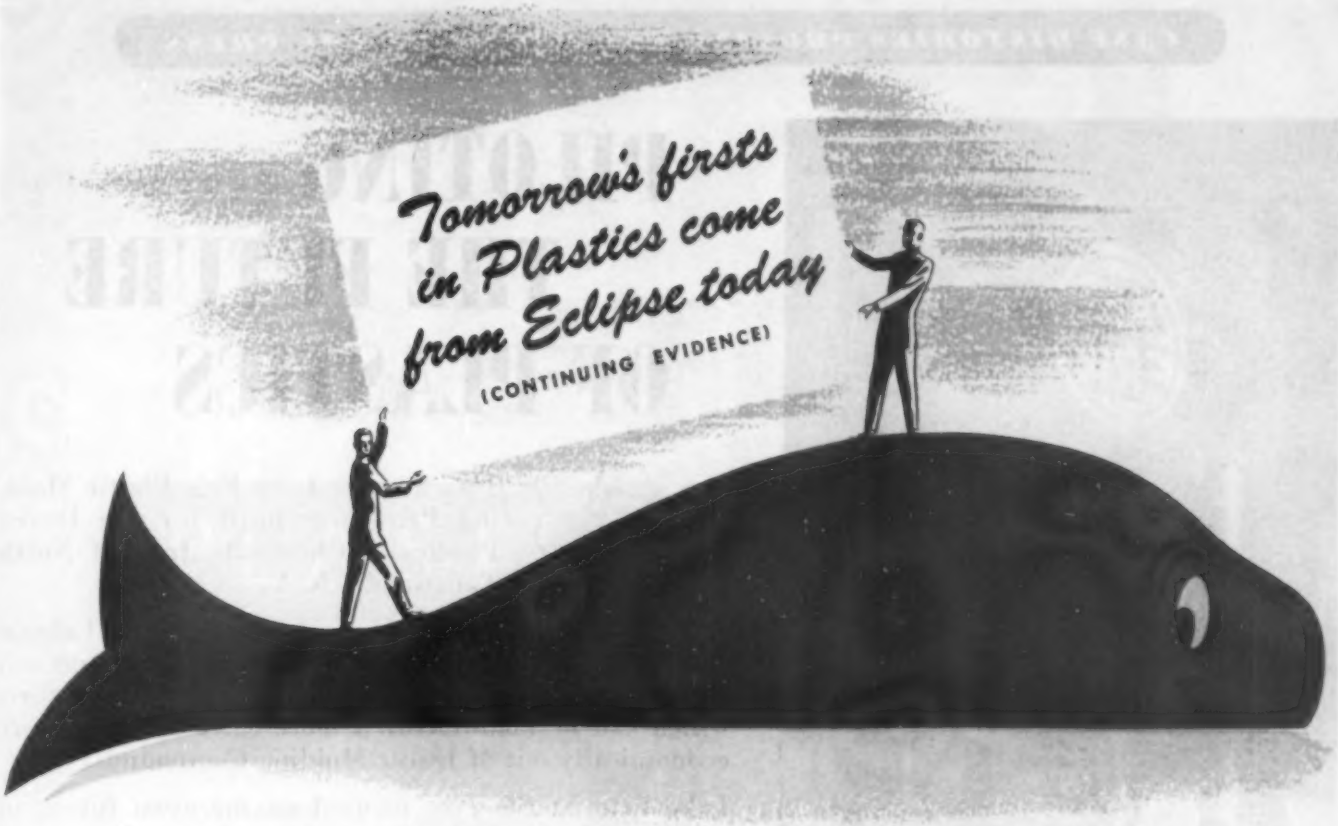


Take a Recess from Slotted-Screw Costs and Troubles

. . . the Tapered, Engineered Recess of:

AMERICAN PHILLIPS *Screws*

Put the Screws on the Japs . . . BUY BONDS!



LARGER

PLASTIC PARTS THAN EVER BEFORE

Opening many new uses for plastics, Eclipse now offers you facilities for successfully producing parts larger than any presently manufactured.

TODAY this service is available — at Eclipse! It will free you from size limitations on many profitable parts, increasing tremendously your application of INJECTION, and COMPRESSION moulded parts on your new products.

ALSO COMPLETE FABRICATING FACILITIES

Typical also of Eclipse' swift progress in plastics is a FABRICATING DEPARTMENT fully equipped to completely handle many of your assembly production tasks involving plastic parts.

Eclipse' record of "firsts" in plastics is your constant assurance of a profitable solution to your plastic moulding problems — for today's and tomorrow's needs. Write, or send blueprint for quotation and suggestions.

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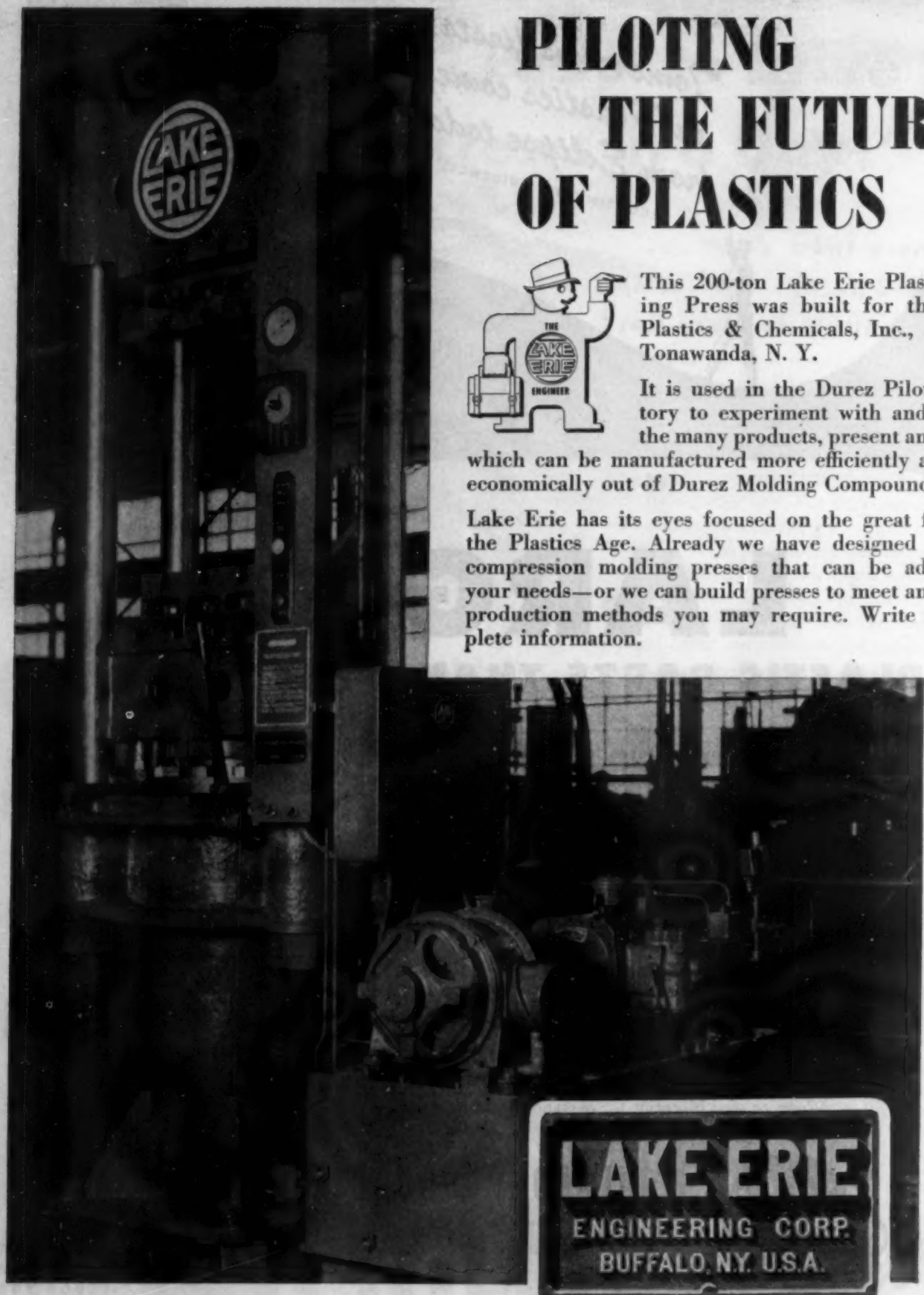
CHICAGO • CINCINNATI • CLEVELAND • DETROIT • KANSAS CITY • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SEATTLE

COMPRESSION • INJECTION • MOULDING IN ALL PLASTIC MATERIALS



PILOTING THE FUTURE OF PLASTICS

This 200-ton Lake Erie Plastic Molding Press was built for the Durez Plastics & Chemicals, Inc., of North Tonawanda, N. Y.

It is used in the Durez Pilot Laboratory to experiment with and test out the many products, present and future, which can be manufactured more efficiently and more economically out of Durez Molding Compounds.

Lake Erie has its eyes focused on the great future of the Plastics Age. Already we have designed standard compression molding presses that can be adapted to your needs—or we can build presses to meet any special production methods you may require. Write for complete information.

LAKE ERIE ENGINEERING CORP.
868 Kenmore Station, Buffalo 17, N.Y.

BAKER®

PLASTICIZERS

for

Vinyl Resins

Phenolic Resins

Urea-Formaldehyde Resins

Cellulose Resins

Melamine Resins

Styrene Resins

and

Buna-S

Buna-N

Neoprene

THE
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Established 1857

120 Broadway, New York 5, New York

Chicago, Illinois

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● BAKER PLASTICIZERS CONTAIN NO PHTHALATE

. . . on Your Sanding Problems

Here is a Behr-Manning Product Engineer determining the proper abrasive belt recommendation for a new type structural plastic submitted for test to our clinic laboratory.

Thermosetting, thermoplastic, cast, laminate, fibre filled, mineral filled—each plastic type has its own sanding and finishing characteristics, and these must be just as carefully examined as their other physical properties.

Increased production, improved quality and lower unit cost to our customers, are best arrived at through these findings and recommendations.

There is a correct Behr-Manning coated abrasive for your plastic sanding operation. There is a Behr-Manning Field Engineer to recommend it for you—and a staff of Behr-Manning Product Engineers to laboratory test your product sample if you have a special problem. Phone, write or wire our nearest branch.

Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Grand Rapids, High Point, Indianapolis, Los Angeles, New York, Philadelphia, St. Louis, San Francisco, Tacoma.

Maximum CUT Minimum COST

BEHR-MANNING · TROY, N. Y.

(DIVISION OF NORTON COMPANY)

QUALITY COATED ABRASIVES SINCE 1872

MONROE

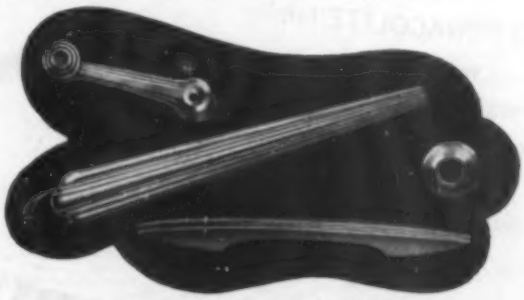
Metal Plating of Plastics

Increases Flexual Strength 21%!

Reports large Eastern manufacturer after testing

Makes Products and Parts
BETTER-MORE ATTRACTIVE-LESS EXPENSIVE!

. . . adds also to tensile strength and impact strength . . .
increases dimensional stability . . . gives plastic parts higher resistance to absorption
and corrosion . . . when lead plated, forms perfect electrical shield
. . . lends itself to production of attractive novelty finishes . . . novelty
products . . . opens up whole new range of possibilities for use of plastics
. . . works with any plateable material . . . alert manufacturers
will want to investigate thoroughly.



Assistance offered your designers and engineers for testing specific applications.

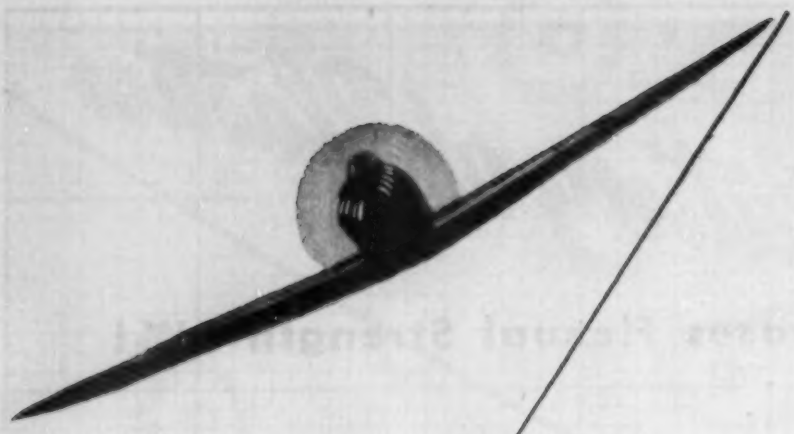
PLASTICS DIVISION

MONROE

MONROE AUTO EQUIPMENT CO. MONROE, MICH.

THE METAPLAST PROCESS

ARMY E NAVY



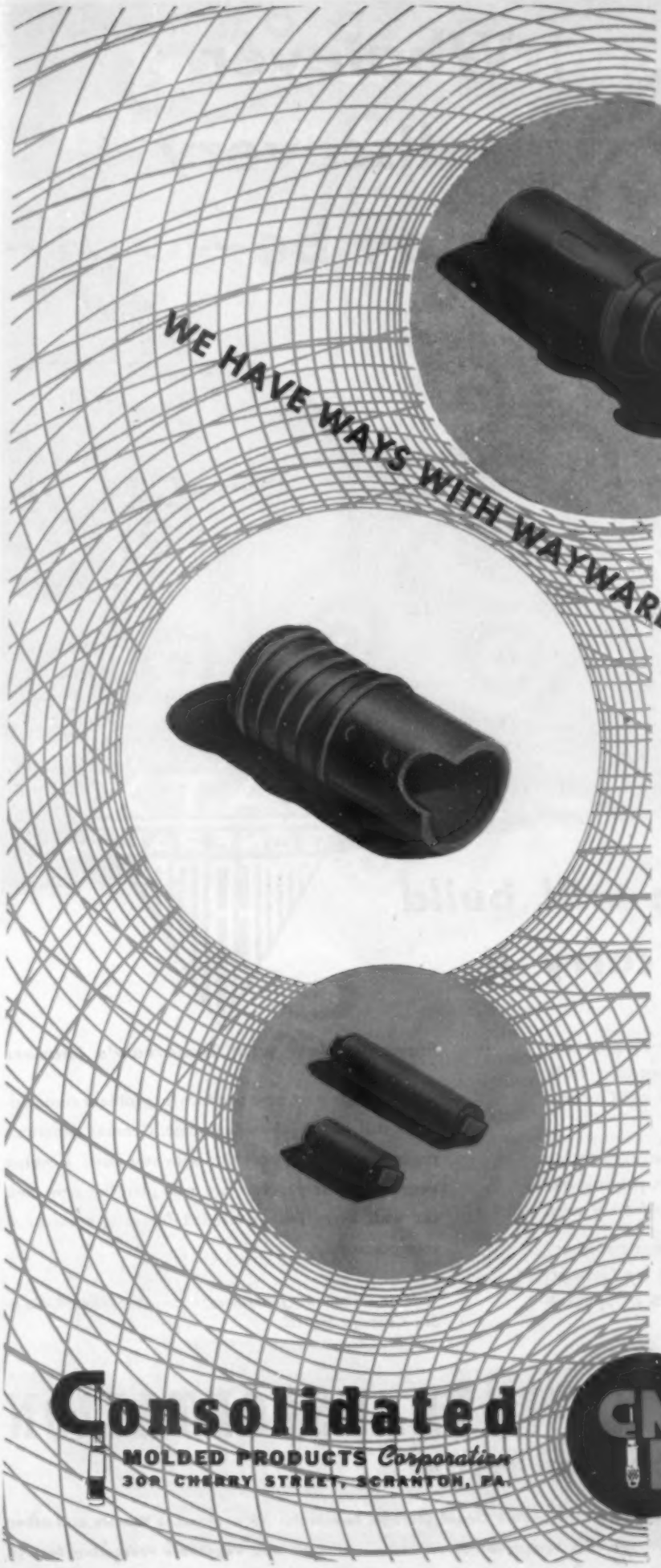
PENACOLITE

vital to the great ships
. . . air and water . . .
dealing Victory blows to our enemies
PENACOLITE
has won universal acceptance
as the criterion
of resin adhesive
quality and performance.

New products
of the PENACOLITE family
will maintain
the same war-tested and proved standards
. . . for the host of peacetime uses
for which they have been developed.
You'll know them by their manufacturer.

PENNSYLVANIA COAL PRODUCTS COMPANY

PETROLIA, PENNSYLVANIA
55 West 42nd Street, New York, N. Y.



WE HAVE WAYS WITH WAYWARD MATERIALS!

Plastics, filled with mica, have what it takes to function for highly specialized coils . . . at the same time, while in process, it takes all you've got to make the material behave!

Mica is difficult to handle . . . must be formulated with extreme care . . . the molds themselves must be ingeniously developed . . . flawlessly constructed . . . specially finished. Each step up to and through transfer molding calls for "babying"; otherwise, you get chips and flakes for your effort. Such a condition is *taboo!*

As you can note here, the finished parts are usually small—intricately designed—incorporate threading, flanges, holes, cut-aways and other specification set-ups. All call for mold mastery—the Consolidated way!

Inquiries invited from those whose present problems and postwar plans have reached the thinking-out stage. Consolidated guarantees *your blueprint in plastic*—the right plastic!

Consolidated

MOLDED PRODUCTS *Corporation*

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Whatever his discovery may be—

General American will build a tank car to carry it

Your future plans may include new liquids and gases never shipped before — and needing bulk transportation to be profitable. Call on General American engineers.

Specially designed General American cars today carry highly volatile liquids, gases requiring extreme pressures, *acids that corrode ordinary cars.*

The correct car to carry your "problem product" efficiently can be designed and built by General American — world's largest operators of specialized tank cars.

Planning Now with Tomorrow's Leaders

Even though your new product or problem commodity is still in the laboratory stage, General American engineers are ready to work with you now. Keeping pace with your progress, we will plan the new tank car with every feature needed for safe, economical transportation.

Call or write our general offices—135 South LaSalle St., Chicago 90, Ill.

GENERAL AMERICAN TRANSPORTATION CORPORATION

Builders and Operators of Specialized Railroad Freight Cars ★ Bulk Liquid Storage Terminals ★ Pressure Vessels and other Welded Equipment ★ Aerocoach Motor Coaches ★ Process Equipment of all kinds ★ Fruit and Vegetable Precooling Service

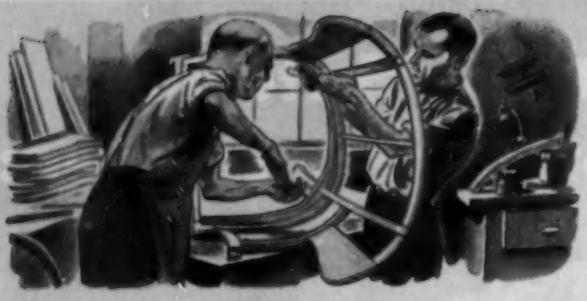
To Conserve Critical Materials this paper prescription was created:

MOSINEE, as a war material, has solved many manufacturers' critical supply problems. "Discoveries" in paper and processing, important also to postwar production, have resulted from cooperation between manufacturers, product engineers, and paper technicians of The Mills of Mosinee.

The MOSINEE presciption outlined above is a typical development, resulting in paper that is serving the war effort with complete satisfaction. Discussions with Mosinee engineers may disclose valuable opportunities for you in modern "Essential Papers" with specified high bursting strength . . . dielectric, tear or tensile strength . . . pliability, controlled acidity or alkalinity . . . water repellency, accurate caliper, uniform density or other technical characteristics required by your product. Mosinee experience and facilities are available now, for present or postwar planning.

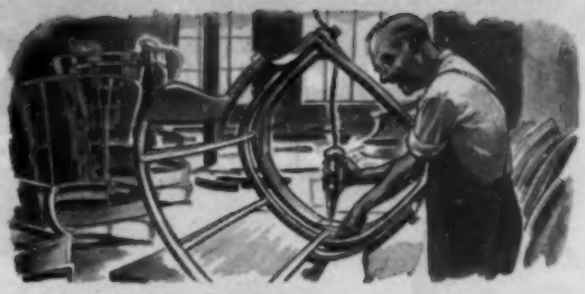
MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

Please address your letter "Attention Dept. A"



BACKLOG BREAKERS!

Finding it impossible to keep pace with orders as long as he used slotted screws, one leading furniture maker broke up his assembly jams once and for all by switching to faster-driving Phillips Recessed Head Screws.



MONEY MAKERS!

This switch cut assembly time almost in half. It cut 10% off pre-assembly by making pilot holes unnecessary. On top of this it saved 33-1/3% in labor costs because Phillips Screws drive so much faster!

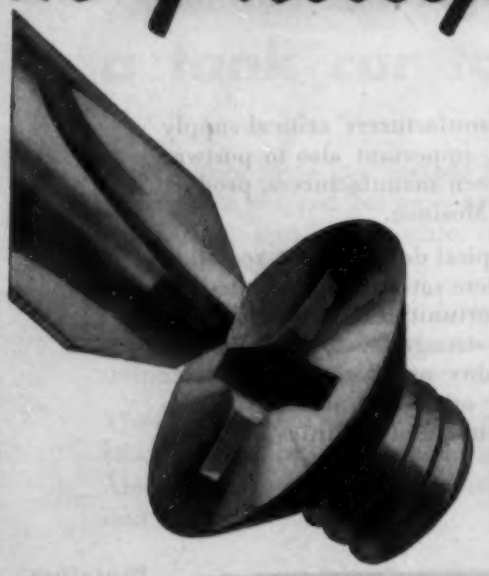
PRECEDENT SHAKERS!

Pace-setters in production and cost-reduction activities, Phillips Screws are helping designers shake things up, too. Much more strength and rigidity can be built into products than was ever possible with slotted screws.

ORDER TAKERS!

And when it comes to buy appeal, other screws just aren't in it with Phillips Screws. Salesmen say they banish burrs that endanger both clothes and sales . . . and make *any* product look stronger, smarter, trimmer!

It's Phillips — the engineered recess!



In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

. . . It's the exact pitch of the angles that eliminates driver skids.

. . . It's the engineered design of the 16 planes that makes it easy to apply full turning power – without reaming.

. . . It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50% – cut costs correspondingly?

To give workers a chance to do their best, give them faster, easier-driving Phillips Recessed Head Screws. Plan Phillips Screws into your product now.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

Made in all sizes, types and head styles

25 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
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Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
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CUT YOUR INVESTMENT RISK IN POST-WAR RETOOLING—

and stay flexible enough to quickly meet uncertain, changing conditions of the immediate future . .

. . . with low-cost, high-production

Delta-Milwaukee Machine Tools

TURN THE PAGE!

In almost every department of your plant:

- ✓ Parts Production
- ✓ Assembly
- ✓ Tool Shop
- ✓ Maintenance Shop
- ✓ Foundry
- ✓ Pattern Shop
- ✓ Shipping Department
- ✓ Laboratory

— on a wide variety of applications in working metals, plastics, wood, and other materials . . .

. . . when you tool up

Delta Carbide Tool Grinder

Combined with the Delta standard tool grinder for hogging down the shank steel, this vibrationless unit gives you a perfect working combination for sharpening tungsten carbide tools, with a remarkably small initial investment.

Delta Grinder with Twin-Lite Safety Shields

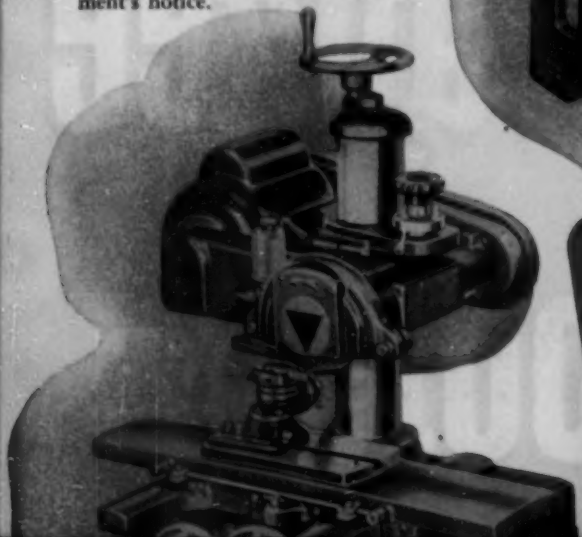
Your greenest apprentice can't forget goggles, when using this machine — safety glass shields are built right in! Both wheels are flooded with light, to assist accurate tool grinding. Easily-adjustable, machined tool rests.

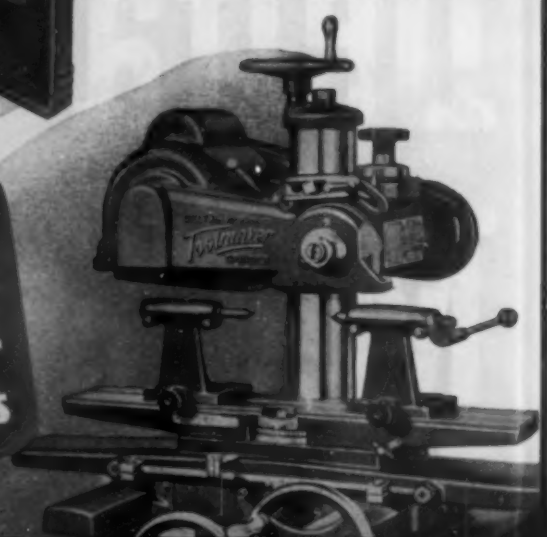
Delta Toolmaker Surface Grinder

Low cost and portability permit this husky, big-capacity grinder to be quickly swung into any spot to free machines costing many times as much. Designed for ease and speed of surface grinding, tool sharpening, and any grinding operations within its range. Convenient controls . . . wide graduations on micrometer for close settings . . . unique wheel-adapter that saves time on truing-up operations . . . many other advantages that help assure you of creditable performance. 7x1½" wheel; 1¼" bore. Table surface 5¾"x13".

With the Univise, the first truly universal vise for grinding, drilling, and milling — and the coolant attachment—this machine serves as a dependable, accurate Chip-Breaker Grinder for grinding the chip-breaker groove on carbide-tipped tools. Holds the tool at any conceivable angle — accurately reset at a moment's notice.

With the Unihead, and the tool and cutter grinder attachment, this machine becomes the latest development in Tool and Cutter grinding. Simple, accurate, and very low in cost. Delta construction features assure perfect alignment and freedom from play. Substantially built and machined to very close tolerances.





DELTA
MILWAUKEE
Machine Tools

...with Delta-Milwaukee Machine Tools

Delta 14" Metal-Cutting Band Saw

Saves time and money on many general tool and machine shop operations—sawing off tool, die, and fixture stock; cutting templates and similar tools; cutting almost any material from carbon steel to asbestos.

Delta 6" Abrasive Belt Finishing Machine

Reduces cost per unit for precision finishing, polishing, edging, burring of small parts. Completely flexible in operation—can be set vertically or horizontally. Has lubricated-for-life ball bearings and other quality features.

NEW!

Delta Super-Hi-Speed Drill Press

. . . a low-cost 14" machine for precision small-bore operations

Here's a new drill press that is interchangeable with the standard Delta 14" model on the regular 14" drill press column. It has all the famous quality features of Delta-Milwaukee Machine Tools — plus special refinements necessary for small-bore drilling of plastics, aluminum and other light non-ferrous metals: 60 cycle motor, with three-step pulley, permitting speed range of 12000 . . . 8100 . . . 5000 R.P.M. Movable motor mounting plate, to adjust belt tension. Specially-selected Jacobs chuck with drill capacity of from .025" to ¼". Spindle travel of 2½". Head, complete with motor, available separately.

Write for free, descriptive bulletin.

Consult your Delta-Milwaukee distributor regarding priorities and deliveries on these machine tools.

140 case histories of war production experience in

DELTA'S 76-PAGE BLUE BOOK

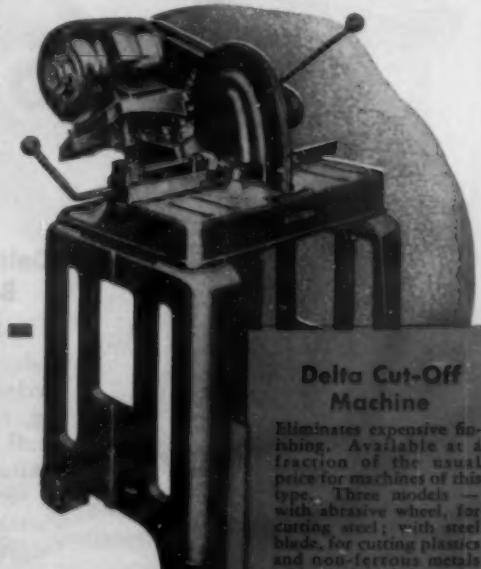
suggest money-saving peacetime applications in your plant

This book, sent to you without obligation, can help you more clearly visualize — and utilize — the versatility of portable, compact Delta-Milwaukee Machine Tools. • It may suggest—as it has in many cases — using regular stock-model Delta elements to build special-purpose machines that can be quickly converted to other uses when requirements change . . . or modernizing obsolete machines, by replacing worn units with standard Delta elements . . . or using low-cost Delta tools to quickly revise production-line layouts to get the best sequence of operations for increased man-hour output. • This modern way of retooling is practical, because your capital investment is held to a minimum. Delta cost savings are due to modern production methods applied to a large volume of standard models — not to short-cuts in quality. • Also available is a catalog of Delta-Milwaukee Machine Tools. Send for both books.

Use the coupon below.

These quality features minimize depreciation of your Delta-Milwaukee Machine Tools:

1. ***Double-sealed New Departure ball bearings*** are lubricated for life . . . double-protected against abrasive shop dust.
2. ***Pre-loaded bearings*** prolong bearing life, by eliminating unnecessary play between balls and races.
3. ***Precision-bored bearing seats*** assure true-running shafts that stay accurately aligned.
4. ***Balanced pulleys*** prevent the transmission of belt-vibration to spindle—thus reducing spindle wear.
5. ***Precision-ground shafts,*** ground to close tolerances, run true, smoothly, and without vibration.



Delta Cut-Off Machine

Eliminates expensive finishing. Available at a fraction of the usual price for machines of this type. Three models — with abrasive wheel, for cutting steel; with steel blade, for cutting plastics and non-ferrous metals with polished smoothness; with cross-cut blade, for cutting wood.

THE DELTA MANUFACTURING CO.
656E E. Vienna Ave., Milwaukee 1, Wisconsin

Please send my free copy of the 76-page Blue Book, and catalog of low-cost Delta-Milwaukee Machine Tools.

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Piping Hot at 40 below

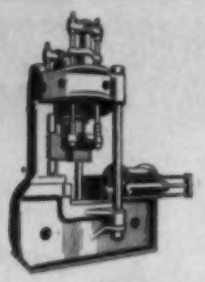
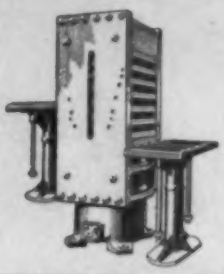
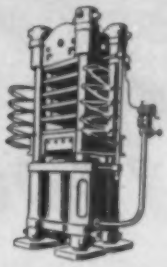
Food is kept hot for bomber crews in a thermostatically controlled unit. Tops of food cups for soup and coffee are molded from boiling water resistant melamine, with screw caps that fit tightly—avoid spilling. Because of their long experience in handling melamines, Watertown was chosen to mold these sturdy sanitary tops.

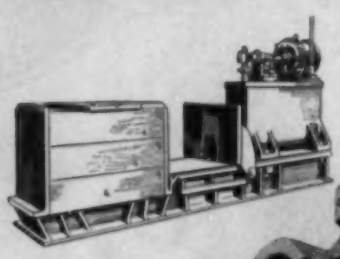
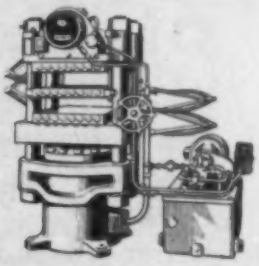
The Watertown Manufacturing Company, 1000 Echo Lake Road, Watertown, Conn. Branch office—Cleveland • Sales offices—New York, Chicago, Detroit, Milwaukee.

Courtesy The Toppan Stove Company, Mansfield, O.

Watertown

A NAME AS OLD AS THE PLASTICS INDUSTRY

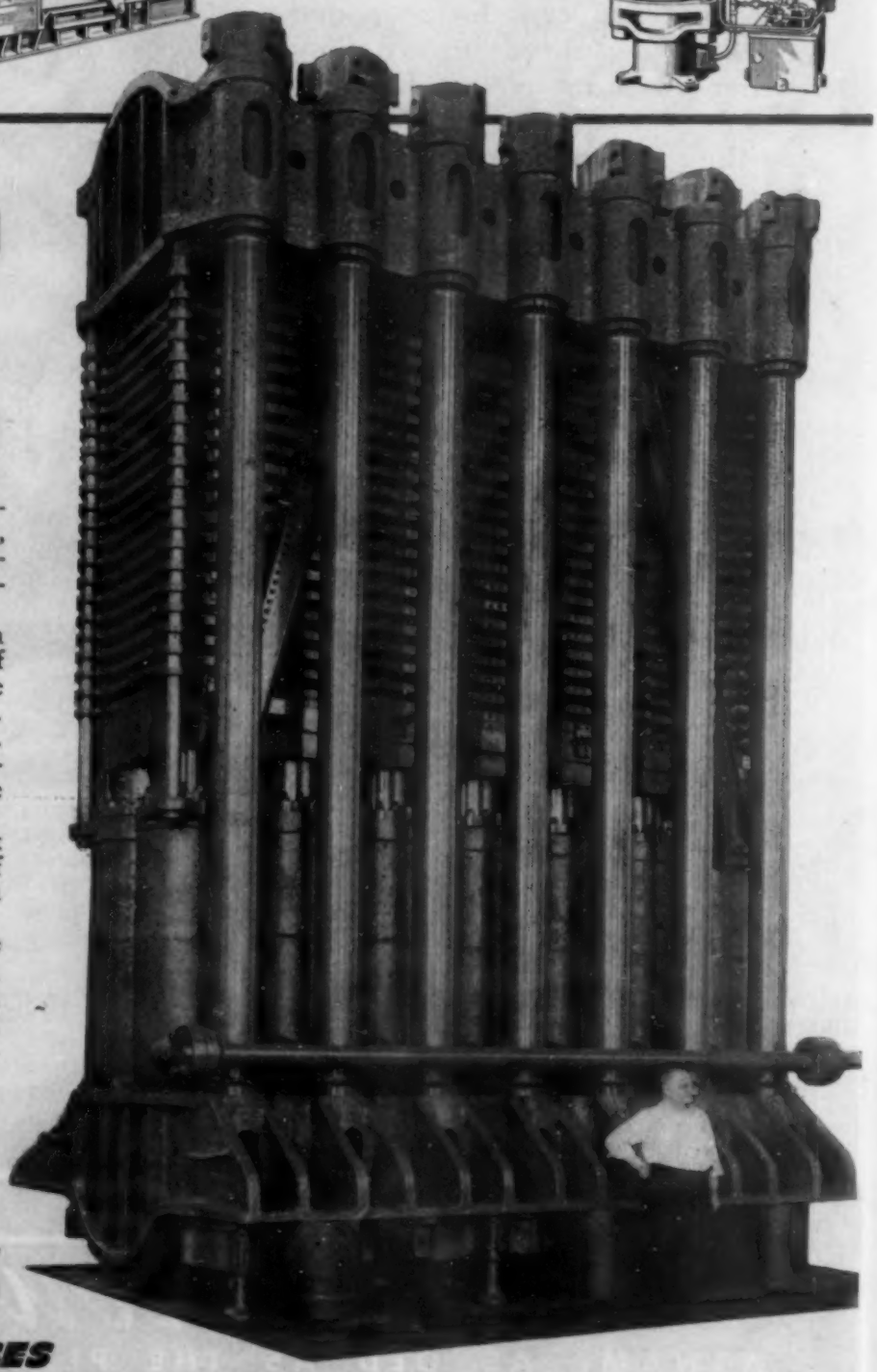
A 7000-ton *expeditor* of Production

Here's a press that's sized and engineered to do the biggest, toughest jobs, let you meet today's production schedules on time, and be ready to meet tomorrow's competitive conditions.

This 7000-ton, 20-opening, Steam Platen Press is only one of the line of special and standard presses that are helping others . . . and can help you. Several types are illustrated above . . . and if your requirements call for something entirely new, Baldwin experience is ready to design and build it.

Before you purchase any press—talk to our engineers. They've got a lot of ideas that you'll find profitable and a press to fit your needs.

The Baldwin Locomotive Works, Baldwin Southwark Division, Philadelphia 42, Penna. Offices: Philadelphia, New York, Washington, Boston, Chicago, St. Louis, Cleveland, San Francisco, Houston, Detroit, Pittsburgh.

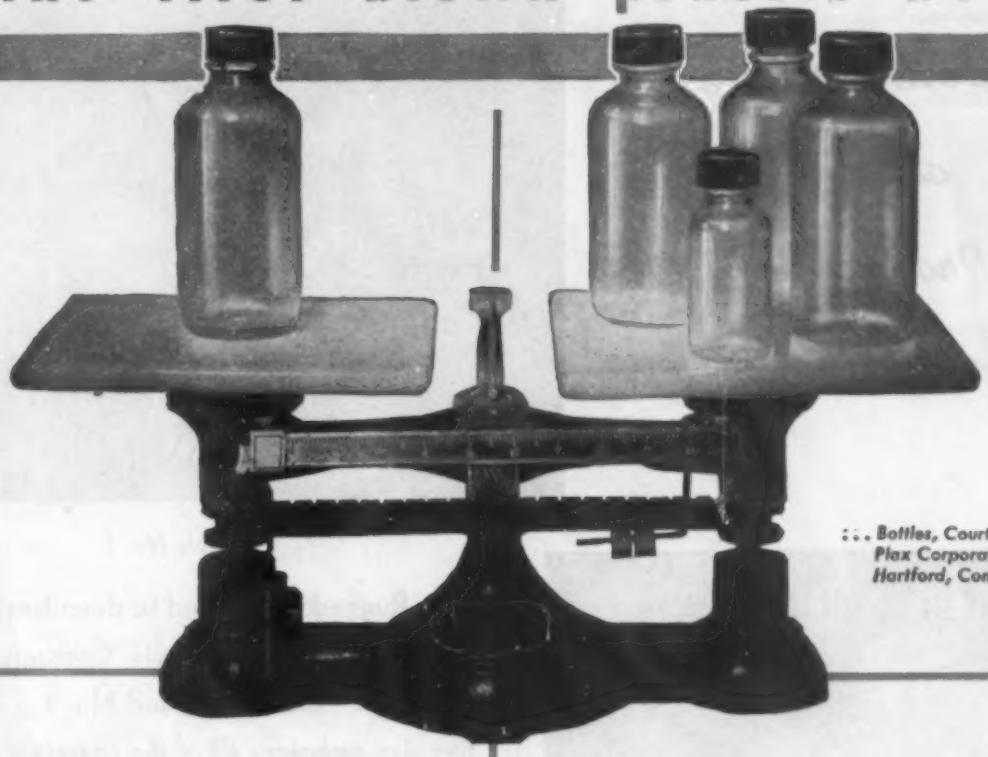


BALDWIN

HYDRAULIC PRESSES

LUSTRON

for the first blown plastic bottles



. . . Bottles, Courtesy of Plax Corporation, Hartford, Conn.

1/3 the weight of glass;
1/12 the tare

Here at last is the *practical* plastic bottle, extrusion blown with Monsanto's versatile polystyrene, Lustron . . . now in continuous, automatic production after years of development work by Plax Corporation.

Lighter, thinner, yet less fragile than glass, millions of these new bottles of Lustron have been going overseas to meet the urgent needs of our Army and Navy Medical Corps. For shipment by air or sea, where weight and space are precious and rough going commonplace, the Lustron blown bottle has proved itself "just what the doctor ordered" for packaging vital drugs, vitamins, hydrofluoric and other acids and minerals.

Whether it's bottles you are interested in or not, this dramatic demonstration of Lustron's *extreme moldability* — combined to all its other utilitarian and alluring virtues . . . makes significant production news.

Think, too, of the gem-like, lustrous surfaces . . . the exciting color range, all the way from clear transparent, through the delicate pastels on to rich opaques! Think of Lustron's practical advantages: the resistance to alcohol, alkalis, and all but the strong oxidizing acids . . . the dimensional stability . . . the strength and non-shattering quality!

For full information on Lustron and the ideas it and other Monsanto plastics are inspiring, write, wire or phone: MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Massachusetts.

The broad and versatile family of Monsanto Plastics includes: Lustron polystyrenes • Cerex heat resistant thermoplastics • Vinyl acetals • Nitron cellulose nitrates • Fibestos cellulose acetates Thalid for impression molding • Resinox phenolics • Resimene melamines • Forms in which they are supplied include: Sheets Rods • Tubes • Molding Compounds • Industrial Resins • Coating Compounds • Vuepak rigid, transparent packaging materials.

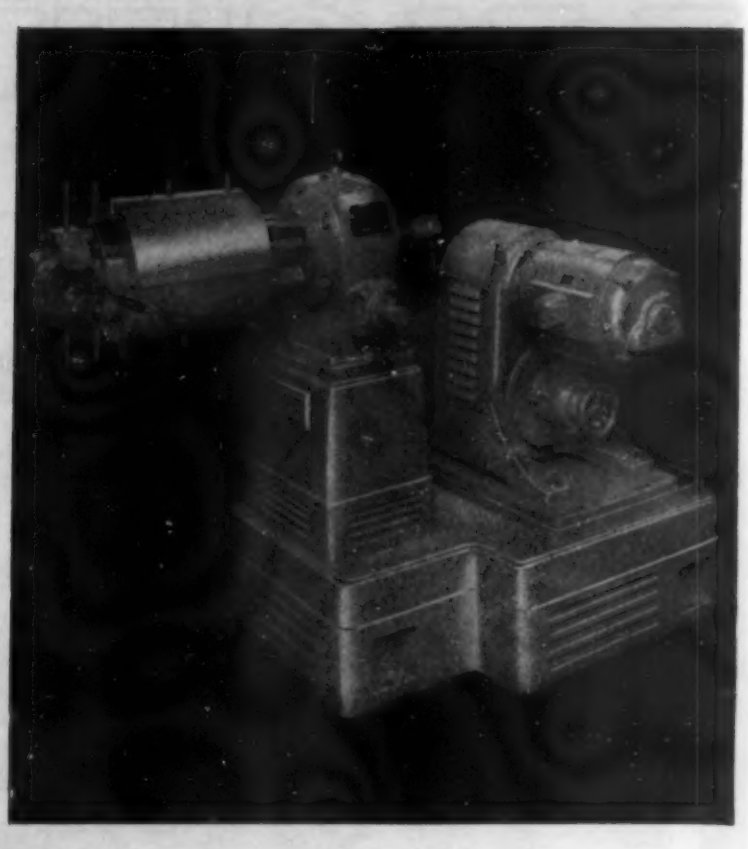
MONSANTO PLASTICS

SERVING INDUSTRY...WHICH SERVES MANKIND

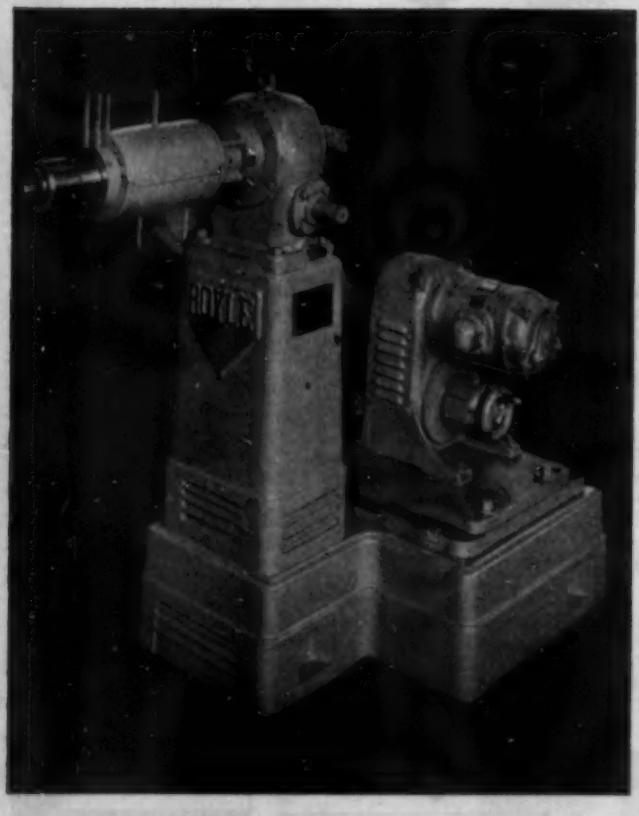
VUE-PAK

TRANSPARENT PACKAGING MATERIAL

Designed For Experimental and Product Extruding



Royle No. 1



Royle No. ½

● Rugged is the word to describe these compact and highly efficient Royle Continuous Extruding Machines—the No. ½ and No. 1. Their diminutive size embraces all of the characteristics required for larger and heavier extruding processes.

● Primarily designed to become an integral part of laboratory equipment—the technician can be sure that his experiments will have true relation to actual product extruding—these machines are economical and efficient producers of such products as tubes, rods, fine wire insulation, mono-filament and thread coating.

● Except for dimensional differences these machines possess identical characteristics.

JOHN ROYLE & SONS

ROYLE
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PIONEER BUILDERS OF EXTRUSION MACHINES SINCE 1880

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NORTON LABORATORIES
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CUSTOM MOULDERS OF SYNTHETIC PLASTICS
BAKELITE DUREZ
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NORLOC NOVELTIES

ALL AGREEMENTS ARE CONTINGENT UPON STRIKES, FIRES, ACCIDENTS OR CAUSES BEYOND OUR CONTROL. CONTRACTS WITH AGENTS NOT VALID UNTIL APPROVED BY AN OFFICER.

May 1945

Dear Plastics User:

Where are plastics going? — That is something that people keep asking us. Because we are in the plastics industry, they seem to think we have the gift of second sight.

Frankly, we can't even begin to guess. Plastics have grown in every way you can think of. The total poundage of materials, the production capacity of the industry, the size of the machines and the number of applications.

Many industries have become acquainted with plastics during the war and will be continuing to expect service from our industry when they go back to making their peace-time products.

We would like to give notice that we will be at the service of all industries once the war is won. Norton has become fairly well known as a sizeable molder who can satisfy the requirements of many varied producers. We have engineered a number of difficult jobs in the past and those experiences, plus the efficiency of a well run molding plant backed by a smoothly integrated organization, should be the basis of a great variety of successful plastic moldings in the future.

We will be glad to handle your job from any point in its production, starting with engineering, design, mold-making, or whatever other problem may be confronting you.

Sincerely yours,

J. B. NEAL
President

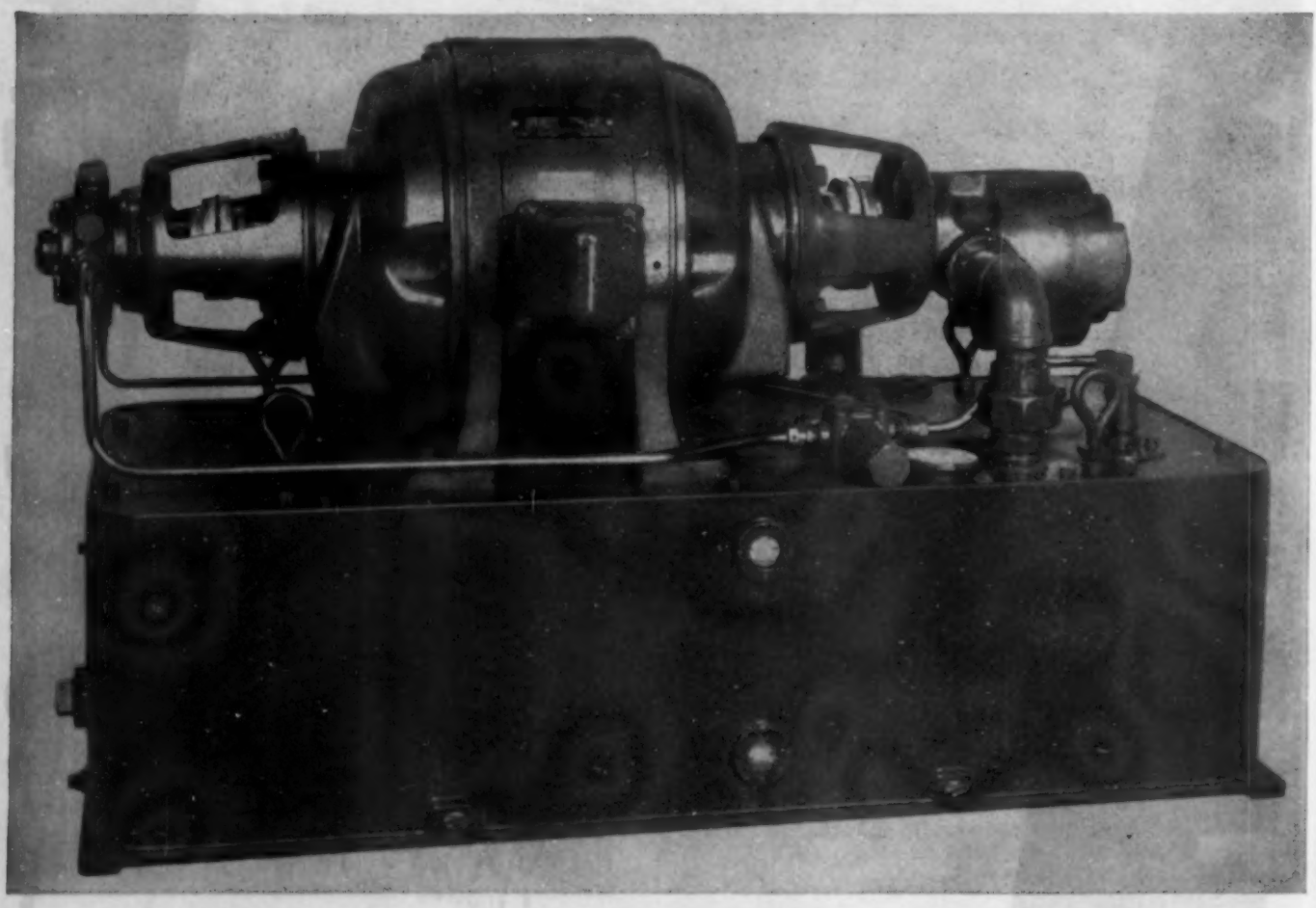
HYCON

Announcing Hi-Lo Hydraulic Power Units

Packaged Units for Fast Prefill
with 3000 p. s. i. Closing and Holding Pressure

Using 10 GPM and 20 GPM Low Pressure Pumps
in Combination with ¾ GPM and 1½ GPM Pumps at 3000 p. s. i.

Units Complete with Pumps on Double End Motor . . . Unloading and Relief Valves
and Micronic Filter . . . All Mounted on 40 Gal. Water Cooled Reservoir



Specifications and Engineering Data on Request

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THE NEW YORK AIR BRAKE COMPANY

Hydraulic Division

420 LEXINGTON AVENUE, NEW YORK 17, N. Y. • FACTORIES: WATERTOWN, N. Y.

"WE'RE AIMING AT THE IMPOSSIBLE"

The need for press equipment to produce very large thermosetting and thermoplastic moldings by high pressure methods has been apparent to the plastics industry for many years. Here at Northwest Plastics, we have designed and will build after restrictions are removed a press for the transfer molding of pieces up to 35 pounds in weight. In the meantime, our smaller presses will handle moldings up to fifteen pounds.

Your requirements for large moldings will receive prompt attention from our engineering staff. Write us today for complete information. Address your inquiry to Northwest Plastics Incorporated, 2233 University Ave., St. Paul 4, Minnesota.

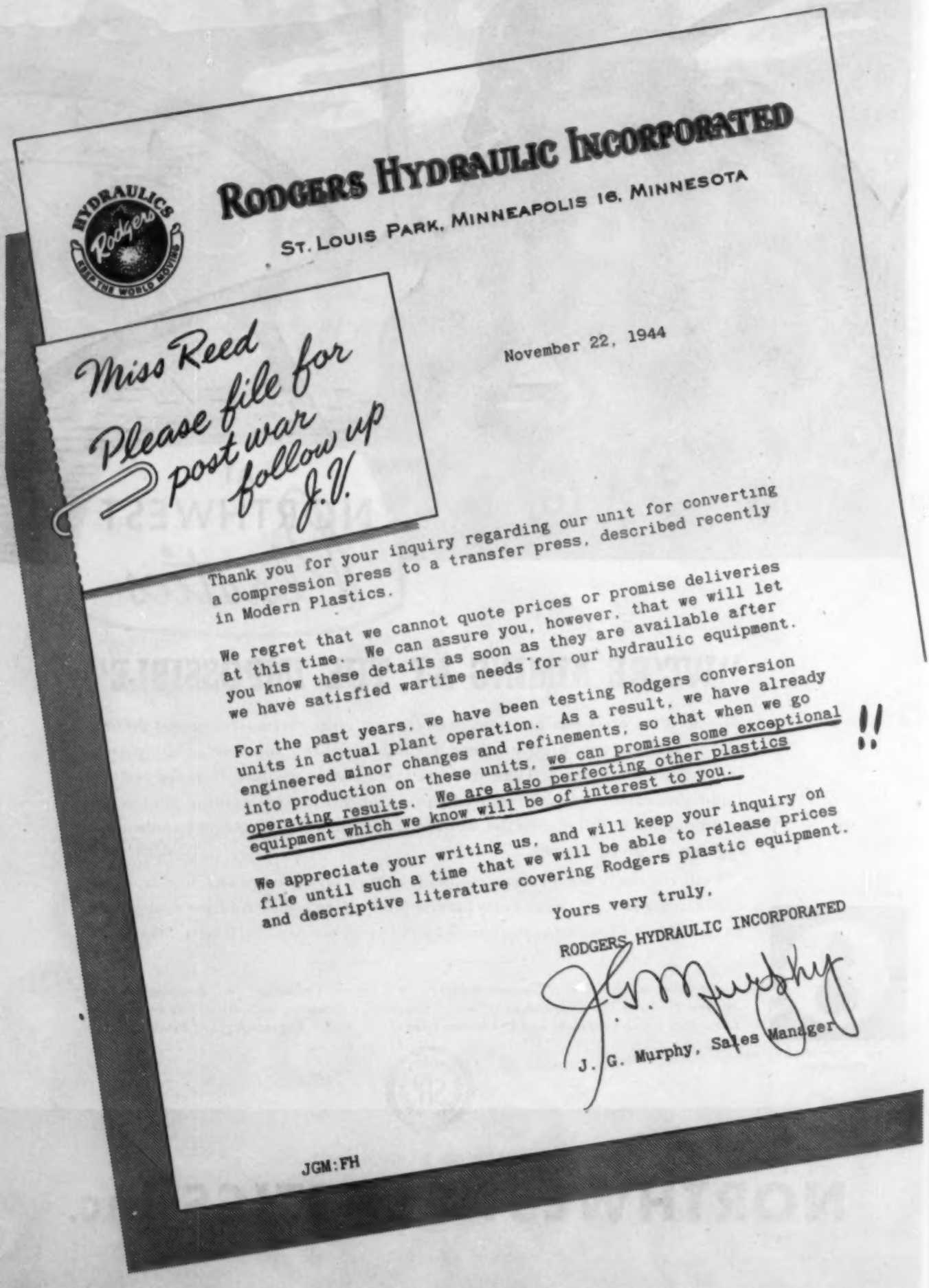
ARMY ORDNANCE AWARD

FOR MERITORIOUS PRODUCTION

Compression molding • Transfer molding • Injection molding • Extrusion molding
Modern Tool and Die Department • Finishing, Fabricating and Assembling Department
Laboratory for Development and Production Control • Engineering and Product Design

SOCIETY OF THE PLASTICS INDUSTRY SPI

NORTHWEST PLASTICS inc.



RODGERS HYDRAULIC INCORPORATED

ST. LOUIS PARK, MINNEAPOLIS 16, MINNESOTA

Miss Reed
Please file for
post war
follow up
J.V.

November 22, 1944

Thank you for your inquiry regarding our unit for converting a compression press to a transfer press, described recently in Modern Plastics.

We regret that we cannot quote prices or promise deliveries at this time. We can assure you, however, that we will let you know these details as soon as they are available after we have satisfied wartime needs for our hydraulic equipment.

For the past years, we have been testing Rodgers conversion units in actual plant operation. As a result, we have already engineered minor changes and refinements, so that when we go into production on these units, we can promise some exceptional operating results. We are also perfecting other plastics equipment which we know will be of interest to you. !!

We appreciate your writing us, and will keep your inquiry on file until such a time that we will be able to release prices and descriptive literature covering Rodgers plastic equipment.

Yours very truly,

RODGERS HYDRAULIC INCORPORATED

J. G. Murphy, Sales Manager

JGM:FH

SALES SUCCESS IN HANDBAGS...

inspiration for radio grilles or grommets, buckles or buttons

Sales winners on a mass production basis come from the cellulosics. This Plasticflex handbag—trade-name of its makers, R. Appel, New York—is typical. Comprising 200 mar-proof cellulose acetate "discs", it fills a long-felt need among women. Constant handling, perspiration, cannot change its color. A damp cloth rapidly restores its luster. The overwhelming demand for these bags was quickly met by high-speed injection molding. One operation puts 36 "discs" on the assembly line.

This example suggests many other applications for the cellulosics. They bring one-shot molding economy and the re-use of scrap; durability, strength, and molded-in beauty; and volume-*proved* sales appeal. They can spell success for *you*.

Lightweight plus toughness for radio grilles

Wear resistance, high finish, for grommets and guides

Enduring color, high luster, for buckles and buttons

HERCULES

CELLULOSE ACETATE
CELLULOSE NITRATE
ETHYL CELLULOSE

For general-purpose production plastics

Hercules does not make plastics or molding powders, but supplies the high-quality cellulose derivatives from which they are made. For data, please write Cellulose Products Dept. MP *HERCULES POWDER COMPANY* Wilmington 99, Delaware. CP-68

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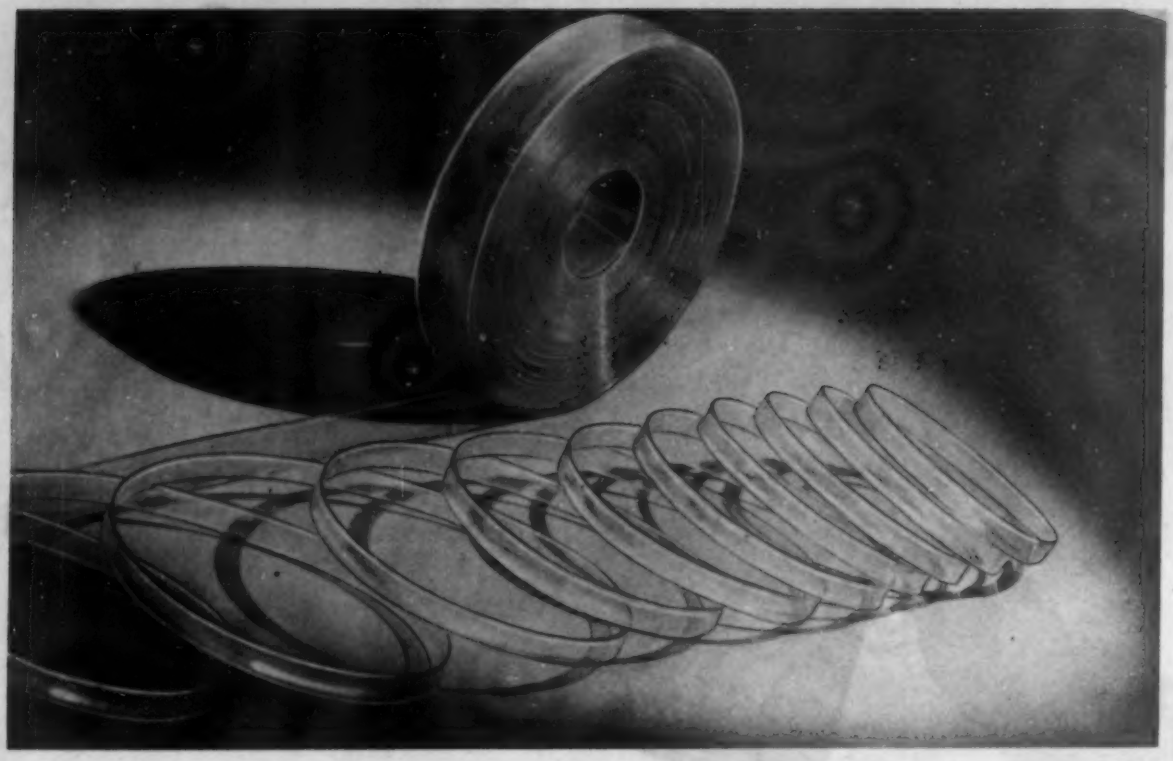


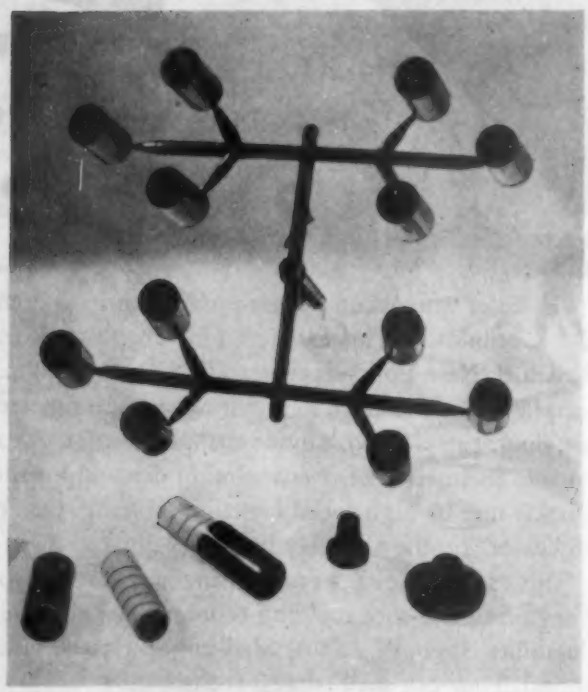
PLASTICS

by EXTRUSION & INJECTION

We Specialize

in all THERMOPLASTICS. Our machinery is most modern, and our workers are skilled and under direct supervision of engineers who have specialized in plastics. Together with our years of experience, you have the assurance of quality, economy, and service when ordering extruded and injection moldings.

A Technical Staff of Plastic Engineers is continually "AT YOUR SERVICE"



Injection molding of intricate, complex or simple forms in large or small sizes. Extrusion of rods, tubes, thread, tape or other shapes in continuous lengths and varied diameters, flexible or rigid.

PIONEERS IN PLASTICS SINCE 1919

CELLUPLASTIC CORP.

CELLUPLASTIC CORPORATION

44 AVENUE L NEWARK, N. J.

WEST COAST REPRESENTATIVES: CONTAINER SERVICE CO., 1266 North Western Avenue, Los Angeles 27, Cal.

LINCOLN

2-Stage HYDRAULIC SYSTEMS

with Selective Intensifier

Will Save Time, Cut Operating Costs, Provide Positive Pressure Control —on Your Presses, too...

Above—A typical control cabinet on a Lincoln Hydraulic System. A single control lever takes care of all operations.

At Right—A Lincoln Booster Pump for Hydraulic Systems. Selected high pressure is automatically sustained without horsepower consumption—no by-passing or pressure relief valves.

CUSTOM MOLDERS

CMC

CONSUMER MOLDING

COMPRESSION MOLDING COMPANY OF ST. LOUIS

1329 SOUTH VANDEVENTER AVE. (10), SAINT LOUIS

NE 0680

PLASTIC WALL TILE

Lincoln Engineering Company
5730 Natural Bridge
St. Louis, Missouri

March 9, 1945

Attention: Mr. Dorsey

Gentlemen:

Attached is our purchase order for another Lincoln Hydraulic System of the same type that we customarily purchase.

We now have seven of your systems in operation at our plant. We have just installed two 16" ram presses in line with the large HPM press and all the presses have molds mounted in them and are running.

In addition to these presses we have purchased six additional presses, all of which will require Lincoln systems within the near future.* We have found that the new 15 H. P. compressor is far in excess for the six presses we have operating and we know definitely that we will be able to add the six new presses well within the limit of our compressor's capacity. That will mean that we are operating twelve plastic molding presses on this one 15 hp motor that would normally require a minimum of 107 hp with the conventional direct drive hydraulic equipment. This is a most interesting fact.

Please let us know how soon we can expect delivery of this additional Lincoln system.

Very truly yours,
COMPRESSION MOLDING COMPANY
Charles D. Pauli, Jr.
Charles D. Pauli, Jr.

This typical letter tells how Lincoln Hydraulic Systems give users outstanding economies. Note particularly the savings in motor horsepower.

LINCOLN ENGINEERS CAN HELP YOU IN SELECTING THE PROPER HYDRAULIC EQUIPMENT...

Recommendations of the proper Lincoln System will be made by our Engineers upon receipt of the following information... Ram Diameter—Maximum Stroke—Platen Size—Total Weight of Platen, Ram and Dies—Distance and Speed of Daylight Closing—Maximum Compression Stroke—P. S. I. Ram Pressure—Time of Cycle desired—and any other related facts affecting operation.

LINCOLN ENGINEERING CO., ST. LOUIS 20, MO.

Please send complete bulletins ☐, or recommendations on the basis of the attached specifications ☐.

*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

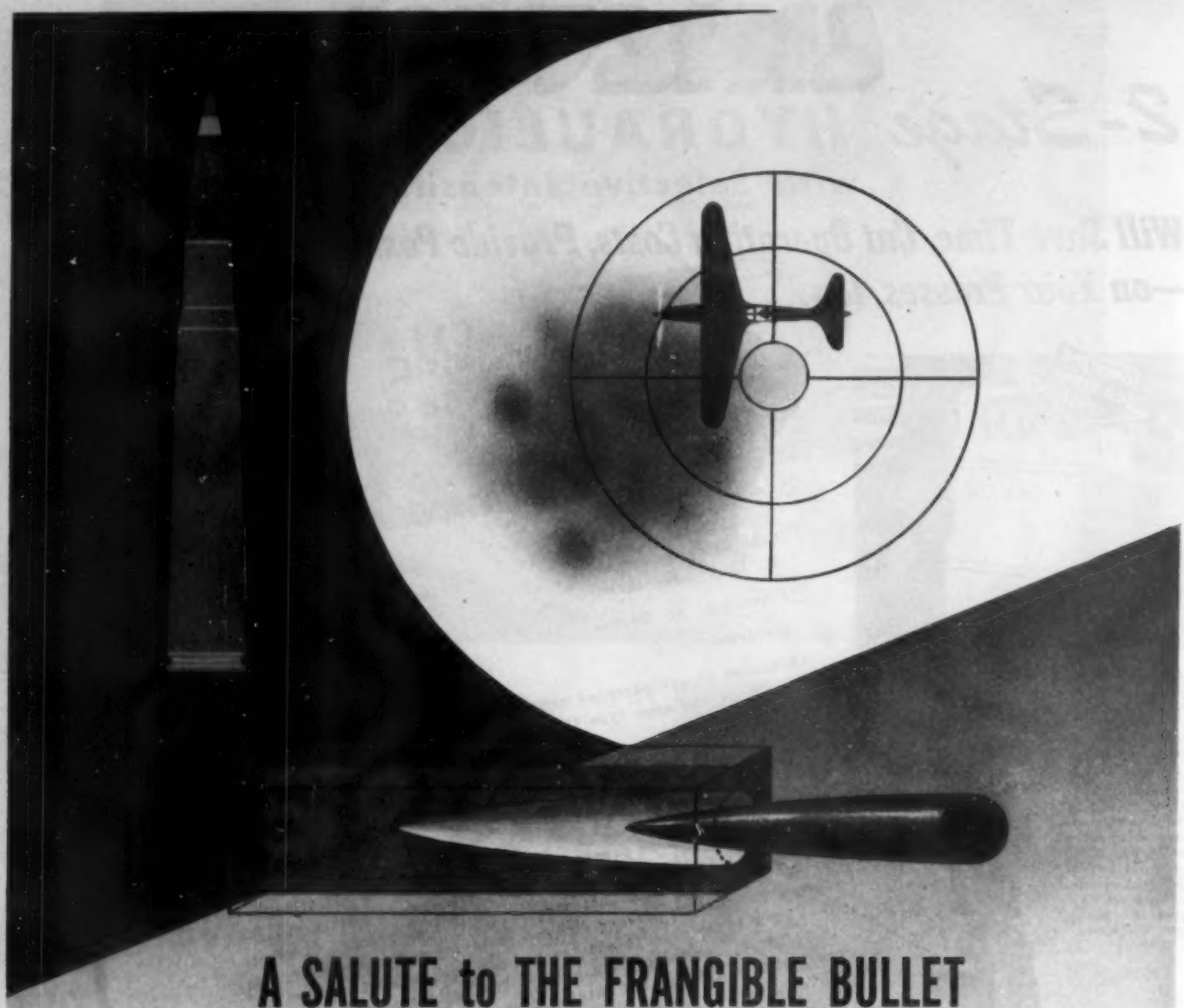
MP 8151

Machine Division

LINCOLN ENGINEERING COMPANY

Pioneer Builders of Engineered Hydraulic Equipment

5701 NATURAL BRIDGE AVE., ST. LOUIS 20, MO., U. S. A.



A SALUTE to THE FRANGIBLE BULLET

The lead-off editorial news break in this issue of Modern Plastics presents, dramatically, the features of this revolutionary outstanding plastics achievement... anything we might add would prove to be repetitious.

We prefer to raise a salute to the accomplishment and to these responsible for its development: The AAF; Duke University; Bakelite Corp.; Newark Die Co.; Shaw Insulator Co.; Boonton Molding Co.

The Industrial Hard Chromium Co. is proud of its proportionate contribution to this highly successful undertaking. By ingeniously devising a technique for applying a thin shell of hard chromium to the contact surfaces and operating elements of the mold units, the problems of sticking, fouling and overheating were solved to the complete satisfaction of the plastic bullet maker-pioneers.

In this application, as in other case histories, hard chromium helped to better the product and produce the vast required quantities much faster. Complete details upon request.

INDUSTRIAL HARD CHROMIUM CO.

"Armorplate for Industry"

15 ROME STREET • NEWARK 5, NEW JERSEY

Sometimes you need someone to tell you Not to Use Plastics

• Although our business here at Imperial Molded is to help people lick those tough molding jobs, we also believe that at times too much emphasis has been placed on the use of plastics.

Plastics are not going to supplant metal, and plastics have already been given a black eye by attempting to take on jobs where metal or metal in combination with plastics should have been considered.

Sometimes you need someone to tell you not to use plastics and Imperial Molded is that type of an organization. In our work here we are handling many highly technical phases of molding work—problems involving multiplicity of inserts, close tolerances, deep drawing, side cores, fine threading, or where some special technique must be used.

If you require a molding service that is organized to handle tough assignments on a completely unprejudiced basis we shall be pleased to work with you—subject, of course, to present day very serious limitations imposed by war work.

IMPERIAL MOLDED PRODUCTS CORP
2927 West Harrison Street, Chicago 12, Illinois

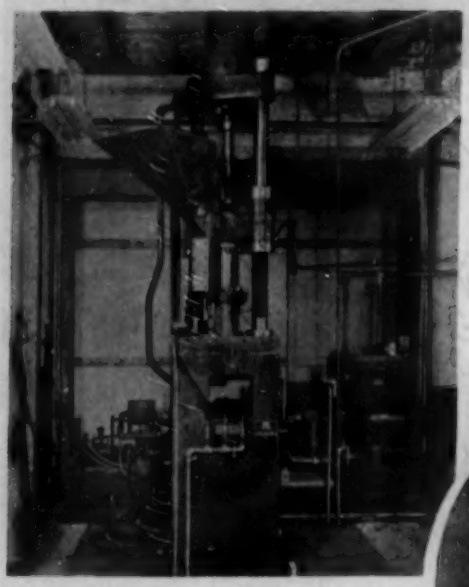
BULLETIN K-200—with its helpful comparative table on the characteristics of various compression molded plastics and a brief picture story of how the Imperial molding plant operates —will be gladly sent at your request.

IMPERIAL *Plastic Molding*

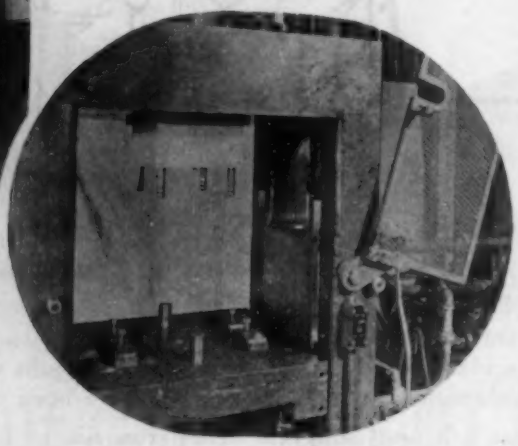
BAKELITE • PLASKON • DUREZ
MAKALOT • TENITE • BEETLE • LUCITE

Injection MOLDING

NUMBER FIVE OF A SERIES



The Lester 3-V-12 is essentially an adaptation of the standard Lester 12-ounce injection molding machine. Here it is shown installed with its base about three feet below the level of the floor, in order to bring the mold aperture to a level convenient for the operator. Seen in the background is the hydraulic system, which can be mounted on the same base with the machine or installed in the basement below. The heavy beam-type steel frame, double-toggle mold-locking mechanism and injection cylinder with hollow plunger are basically the same as those of all Lester models.



This close-up of the mold aperture of the vertical machine shows that mold platens are horizontal and that the entire space is free of bars or other interfering members, so that its entire 21" x 25" area can be used. The movable platen moves within the frame by means of V slides moving in hardened V-grooved inserts.

WILL vertical injection molding machines supersede the horizontal type now in general use?

This possibility seems remote, but it is true that there is a noticeable trend toward vertical design, and some leading plastic molders believe that vertical machines are more efficient and will broaden the scope of the injection molding process.

The machine shown above, installed in the plant of Arnold Brilhart, Ltd., at Great Neck, N. Y., has been highly successful in molding two Lucite parts which were previously thought impossible to make of plastic material. This is the Lester 3-V-12, a vertical machine comparable in capacity to the standard 12-ounce Lester horizontal machine. One of the parts which it is making is a diopter ring for binoculars, first made of metal at extremely high cost and later made of plastic material with unsatisfactory results because the material lacked sufficient strength and broke in use. It is now made with a metal insert, and meets all Government specifications. Its production rate is 200 per hour, made possible by the ease with which inserts are placed and held in the die, which is naturally in a horizontal position.

The other part is a large Lucite ring for a naval instrument, previously made of bronze. Vertical machine design offered a different advantage in the manufacture of this part. The molding is removed from the mold by stripper plates, which are easy to build into a die which is to be used in a horizontal position but would entail much more labor and expense if the die were made to stand on edge in a horizontal press.

Because of the trend in injection molding toward increased insert work and heavier, more difficult moldings, it does seem likely that the demand for vertical machines will grow. More than a dozen V-series machines of standard capacities are now in use about the country, and more are being made. Whether the majority of machines produced during the next decade are of horizontal or vertical design, Lester machines will continue to set the pace in the speedy, efficient, economical and reliable production of high-quality plastic moldings, with or without metal inserts.

Get the Rest of the Story

Additional data on the performance of vertical machines are available in our article, "Enhancing Molding Efficiency", reprinted from *Plastics*. Write today for your free copy.

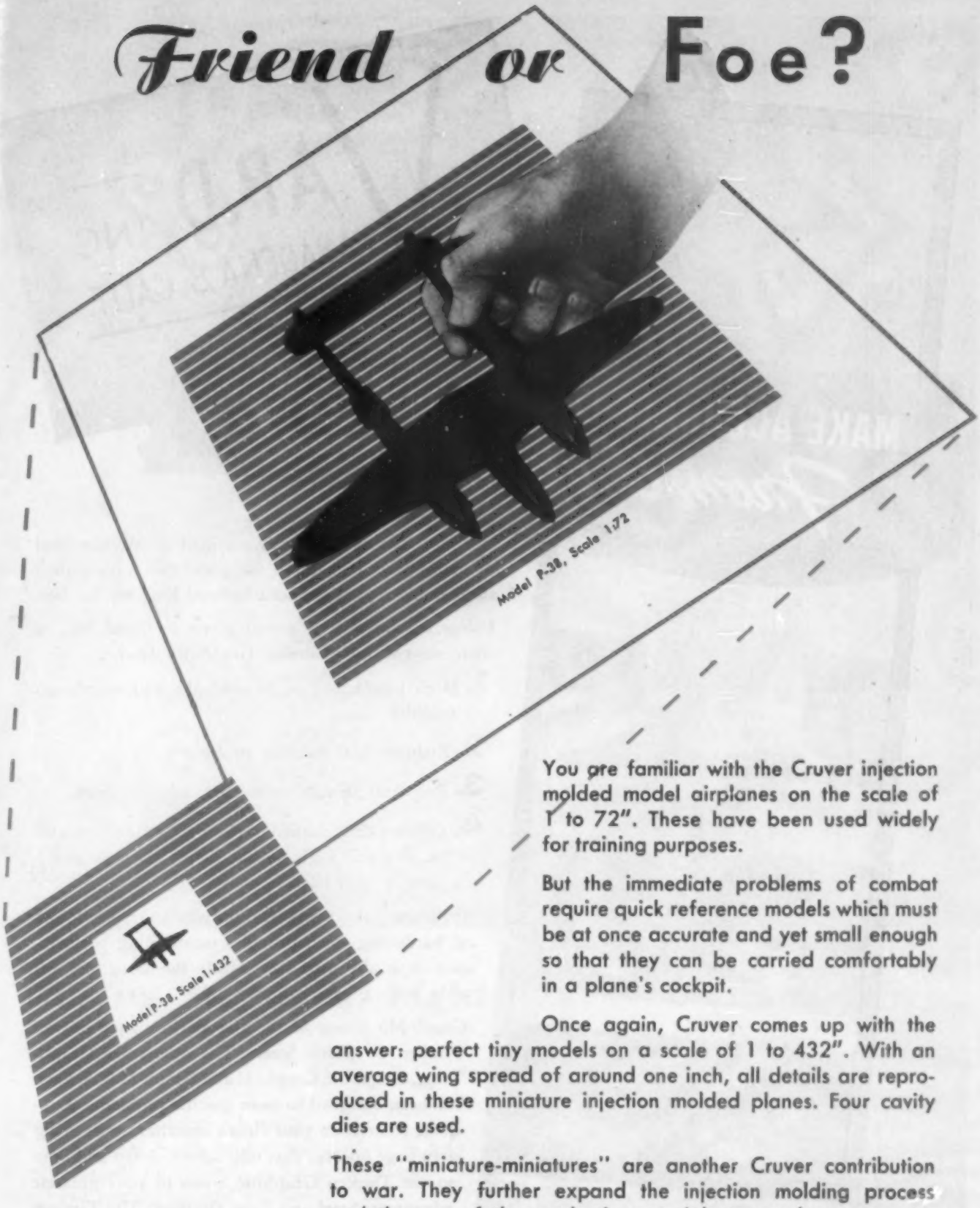
INJECTION MOLDING MACHINES

"Shaping the Things of Tomorrow"

National Distributors:

LESTER-PHOENIX, INC., 2711 Church Ave., Cleveland 13, Ohio

Friend or Foe?



You are familiar with the Cruver injection molded model airplanes on the scale of 1 to 72". These have been used widely for training purposes.

But the immediate problems of combat require quick reference models which must be at once accurate and yet small enough so that they can be carried comfortably in a plane's cockpit.

Once again, Cruver comes up with the answer: perfect tiny models on a scale of 1 to 432". With an average wing spread of around one inch, all details are reproduced in these miniature injection molded planes. Four cavity dies are used.

These "miniature-miniatures" are another Cruver contribution to war. They further expand the injection molding process and the use of thermoplastic materials to produce accurate, stable moldings.

Cruver MANUFACTURING COMPANY

2456 W. Jackson Blvd., Chicago, Ill.

New York N. Y. · Washington D. C. · Detroit Mich.

MAKE ACCURATE LONG WEARING GAGES *From Graph-Mo Steel*

Vard Inc., have used Graph-Mo Steel for many years as material for gages that have gained an enviable record for accuracy and long service life.

Below are listed four points given by Vard Inc., as their reasons for choosing Graph-Mo Steel.

1. High production of gage blanks with minimum machine time.
2. Reduces heat treating problems.
3. Responds readily to stabilization processes.
4. Gages when finished have an exceedingly smooth surface and high polish; therefore, will give a longer wear life.

Gages are just one application where Graph-Mo, an oil hardening steel, provides outstanding performance. It is also used successfully for tools, dies, oil seals, wear plates, spindles, etc.

Graph-Mo is one of the five performance proven Timken Graphitic Steels. The others are Graph-Tung, Graph-Sil, Graph-Al and Graph-M.N.S. Each has been designed to meet specific problems. A request written on your firm's letterhead will bring a 48 page booklet that tells *where, when* and *how* to use Timken Graphitic Steels to your greatest advantage. Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
GRAPHITIC STEELS

Using Strength, Lightness, Wearing Quality

STRENGTH, light weight and wear-resistance make Synthane laminated highly desirable for retainers in high speed ball bearings . . . and an excellent example of putting plastics where plastics belong.

If you haven't used plastics at all or to the fullest extent, if you are not certain *which* of the many plastics fits into your plans . . . or where . . . or why . . . or what the cost will be . . . ask us to help you, preferably *before* you design.

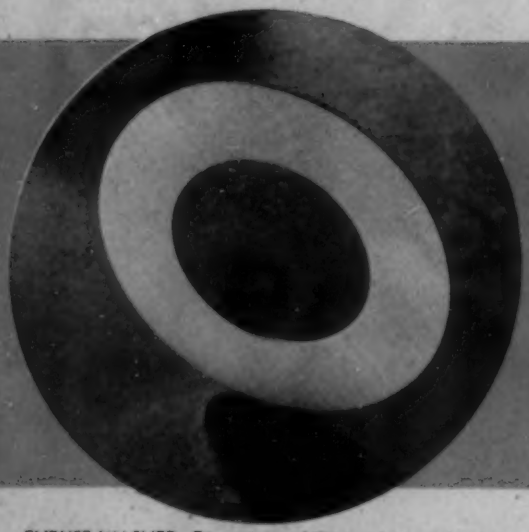
This way, if Synthane is the answer to your needs, you can be sure of design and material not only right for the application but right for fabrication. Should you, in addition, want us to take over fabrication, you can be sure your parts will be produced by men who know machining of plastics, working on machines fitted especially for plastics. For your whole job or any part of it—design, materials or fabrication—remember Synthane. It will give you a real sense of satisfaction to know whether the job can be done, how it can be done, how long it will take to produce and how much it will cost. Synthane Corporation, Oaks, Pa.

SYNTHANE TECHNICAL PLASTICS **DESIGN · MATERIALS · FABRICATION**

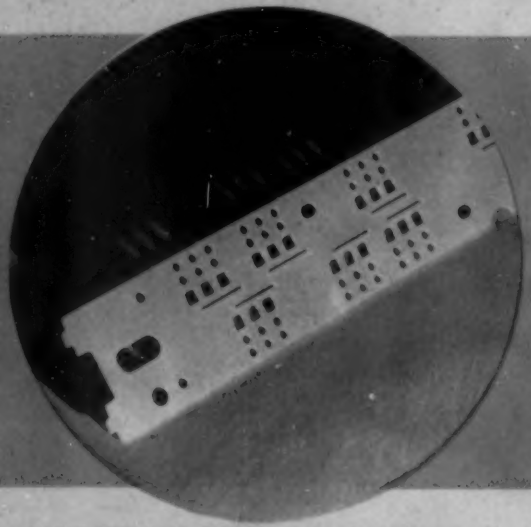
SHEETS · RODS · TUBES · FABRICATED PARTS · MOLDED · MACERATED · MOLDED-LAMINATED

SYNTHANE

Plastics is a Word . . . like Metals



THRUST WASHER—Dimension stability, moisture resistance, compressive strength and immunity to oil are factors in the selection of Grade C (fabric reinforced) Synthane.



RADIO TERMINAL STRIP—Low power factor, low water absorption, low dielectric losses and stability of these properties led to the use of Synthane Grade XXXP.

BREAKER ARM—Synthane molded-laminated with a fabric filler is notable for its high impact strength, excellent wearing qualities and good electrical properties.

• **IT IS IMPORTANT TO AVOID** using the word "plastics" loosely or generically. It is as imperative to distinguish between plastics as between metals, say as between steel and bronze—and then to distinguish further between types of the same general plastics as you would between various steels and various bronzes.

• **SYNTHANE IS OUR NAME** for one type of plastics, made from phenol formaldehyde resins and various fillers. This type is thermosetting, that is, it does not soften under a reapplication of heat as do thermoplastic materials. The phenol formaldehydes, including Synthane laminated, are newsworthy among plastics for their *combination* of high tensile strength, high compressive strength, high flexural strength, high impact strength and high dielectric strength. Synthane has, of course, many other desirable properties in combination such as light weight, hardness, low thermal expansion, low moisture absorption, and resistance to corrosion.

• **THERE ARE, HOWEVER,** various grades of Synthane, just as there are various kinds of bronze, steel, aluminum, and other metals. Naturally, you will not find the optimum values of all properties combined in any one grade. For instance, one grade, reinforced with a paper filler, is most suitable for its mechanical characteristics, another for its dielectric qualities. In addition to paper grades there are grades reinforced with fabric, asbestos, and glass fillers and impregnated with a diversity of resins.

• **THE SELECTION OF A GRADE** of Synthane is influenced not only by its inherent physical, electrical, mechanical or chemical properties but often by processes of machining required to produce from Synthane the finished parts you require.

• **AS AN ILLUSTRATION,** production of the parts you have in mind may only be economical by punching. Depending on your requirements, paper base grades as XP, XXP or XXXP (the "P" denotes a punching or plasticized grade) may be amply adequate for your purpose.

• **USUALLY ONE OF THE MANY** standard grades of Synthane can be found to meet satisfactorily all your specifications, both in properties and in machinability. If not, we may have already developed, or have to develop, a special grade which will.

• **REMEMBER THAT SYNTHANE** is as adjustable within its combination of properties as an alloy of a metal, and that if you are not sure there's a grade of Synthane to fill the bill for you, just ask us. If possible, let us help you before you design and, in so doing, give us the opportunity to assist you in selecting the right Synthane material for your application and for ease in fabrication.

SYNTHANE

SYNTHANE CORPORATION, OAKS, PENNSYLVANIA

Representatives in All Principal Cities

PLAN YOUR PRESENT AND FUTURE PRODUCTS WITH SYNTHANE TECHNICAL PLASTICS · SHEETS · RODS · TUBES · FABRICATED PARTS · MOLDED-LAMINATED · MOLDED-MACERATED

Pioneers

were men after our own hearts!

The Waterloo, P. Q., Canada plant stresses the strategic value capabilities of the MACK organization to meet the requirements of the entire eastern seaboard . . . quickly and efficiently.

The days of this rugged breed may have passed, but their spirit and dogged determination are still very much in vogue. And their attributes have proved no exception in the plastic molding field . . .

Military and essential industrial requirements have demanded a degree of pioneering par excellence. Physical characteristics, materials, finishes, tolerances, etc. have all required unusual ingenuity and resourcefulness to achieve "the impossible."

As with other plastic molders, MACK MOLDING has been proud to play its part in these furtherances. A quarter of a century of molding for industry—large and small—had provided the "pioneering impetus" to do our part of the job. Three completely-equipped MACK MOLDING plants have expedited production in the emergency — Wayne, New Jersey; Arlington, Vermont; Waterloo, P. Q., Canada. Inquiries for post-war projects should be addressed to 120 Main Street, Wayne, New Jersey.

Mack

MOLDED EXCELLENCE

SALES OFFICES: NEW YORK CITY, CHICAGO, DETROIT, INDIANAPOLIS, BOSTON, ST. LOUIS

Aico

PRECISION MOLDED FOR ACCURACY

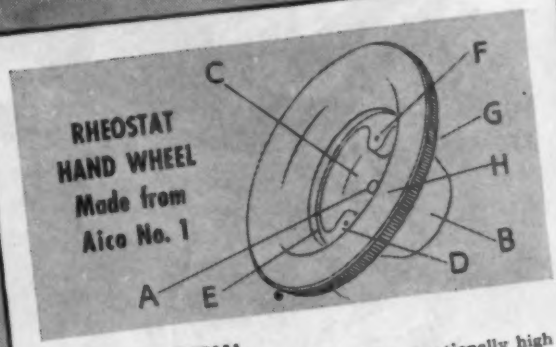
21st

COLD MOLDED *Hand Wheel* IMPROVES PERFORMANCE

Ward Leonard Rheostats, whose major function is the regulation of electric current, are equipped with Aico-molded plastic hand wheels. According to Ward Leonard, this hand wheel adds to the ease of performance of the Rheostat because of the weight, shape and design achieved *in plastics*.

This efficient, cold molded part is an "all-Aico" job. It is manufactured from cold molded material made at Aico . . . designed and engineered by Aico's skilled technicians.

Aico's 29 years of experience and knowledge of all kinds of plastic molding are at the service of product engineers. For the solution to plastics problems, *ask Aico*.



AICO No. 1 RHEOSTAT HAND WHEEL

MOLDING MATERIAL

Aico No. 1 cold molded material has an exceptionally high heat resistance (approx. 600° F.) and extremely low heat conductivity, making it particularly suitable for electrical applications. Although cold molded materials do not have as high an impact strength as some of the other plastics, this lack can be compensated for—in parts requiring greater strength—by placing heavier sections in the design. In the hand wheel, as in many other part designs, weight and bulkier shape are advantageous.

MOLDING METHOD

Cold molding permits a higher production rate than hot molding processes and, consequently, offers maximum economy.

DESIGN

Produced in a single cavity mold, the hand wheel is 7" in diameter and weighs approximately 1240 grams. A large hexagonally shaped insert, with center hole (A) for assembly, extends through the base of the part (B) to within about ¼" of concave surface (C). Bosses (D), level with flat rim (E), are curved for easy removal from the mold. Holes (F) for assembly of other parts are molded in to a depth of ½". Knurled edge (G) and convex rim (H) are designed to provide a good grip. The part has a polished finish.

**This is the 21st in Aico's plastics applications series. Send a request on your letterhead for file cards Nos. 1 to 21.*

Aico

AICO

PRECISION MOLDING

29th Year

AMERICAN INSULATOR CORPORATION

NEW FREEDOM, PA. Sales Offices: Boston • Bridgeport • Cleveland Detroit • New York • Philadelphia

The little man WHO WASN'T all THERE

Pardon us for being facetious but this Little Man's comments have made our Advertising Department a little light headed. No, there's nothing wrong with the Little Man mentally and that section of his stomach really isn't missing. We took the idea for this ad right from Little Man's letter to us.

It seems that he had been tearing his hair for months trying unsuccessfully to find a phenolic, bonding resin to fit a specific job in his plant. He had seen our advertisements and read our offer to help solve the readers resin problems but had never taken us up on it. Then, when he was just about ready to give up he submitted his problem to us.

Our Research Lab popped back with the answer in just 12 working days and Little Man's classic comment was "I certainly wasn't all there when I ignored your invitation for so long."

Do YOU have a knotty, phenolic resin problem that needs untangling? If so, write us today and clearly outline your troubles. Detailed information will speed solution. If one of our standard resins won't fill the bill, our Research Laboratory will try to find the answer for you in short order.. Address your correspondence to Dr. R. D. McDonald, Director of Research.

VARCUM
CHEMICAL CORPORATION
NIAGARA FALLS, NEW YORK

EYES *work better*

with the personally-fitted lighting of

DAZOR *Floating* LAMPS

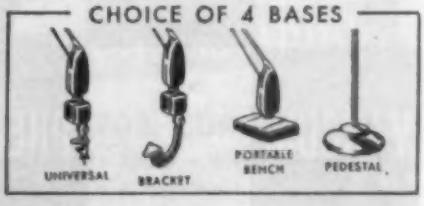
Many of your workers are handicapped by defective vision. You *can't* give them better eyes but you *can* help balance sight inequalities with Dazor *Floating* Lamps: flexible, *localized,* high intensity lighting which provides an *individual fit* for each operator. And easy does it! Fingertip pressure *floats* the Dazor to any desired position, where it *stays put*—without locking or tightening—until moved elsewhere. This is due to a patented enclosed spring force which balances the arm automatically.

Whether for eyes old or young, sound or defective, Dazor *Floating* Lamps make seeing easier on all jobs requiring concentrated and prolonged vision: precision machine work, inspection, fine assembly, and drafting. They help increase output, reduce spoilage, minimize fatigue, promote safety and increase profits.

Call Your Dazor Distributor

For complete information, experienced application assistance and a practical on-the-job demonstration, phone one of the Dazor-appointed distributors in your locality. Their names, if unknown to you, can be secured by writing to the Dazor Manufacturing Co., 4483 Duncan Ave., St. Louis 10, Mo.

IN CANADA address all inquiries to Amalgamated Electric Corporation Limited, Toronto 6, Ontario.



DAZOR *Floating* LAMPS

FLUORESCENT *and* INCANDESCENT

Has the KEY

TO YOUR COMPRESSION PROBLEMS

Our plastic production must be engineered precisely and accurately to fit the needs of your particular application.

New production orders are not merely "grist for the mill" to us.

Your new orders generally give us new opportunities to improve upon past experiences.

We manufacture small parts in a large volume on automatic machines. We may have a helpful suggestion to offer if you will give us the details of your problem and production requirements.

International Molded Plastics INC.

4387 WEST 35TH STREET, CLEVELAND 9, OHIO

IMPACT!

Chemaco Ethyl Cellulose

A tough plastic for tough jobs — Chemaco Ethyl Cellulose meets the strictest tests in vital military and industrial specifications. When operating conditions demand a plastic that can take impact at −40°F. without cracking or chipping, choose Chemaco Ethyl Cellulose. When you need a plastic that is virtually shatter-proof . . . a plastic that will stand up under real abuse . . . Chemaco Ethyl Cellulose is the answer.

For everything from tool handles to battery housings, the easy moldability of Chemaco Ethyl Cellulose furnishes clean, strong sections that provide long lasting service. It is available in colors and translucents—in a wide range of flows to meet your most exacting requirements. Consult Chemaco engineers when you are choosing a material for a special job. They are always glad to offer help in determining the best plastic and the exact formula. Chemaco makes four thermoplastics—Chemaco Cellulose Acetate, Ethyl Cellulose, Polystyrene and both rigid and elastomeric Vinyl Compounds.

Send for the new Chemaco booklet on plastics. Write Chemaco Corporation, 120 Snyder Ave., Berkeley Heights, N. J.

Chemaco Corporation

A subsidiary of Manufacturers Chemical Corporation

Berkeley Heights, N. J.

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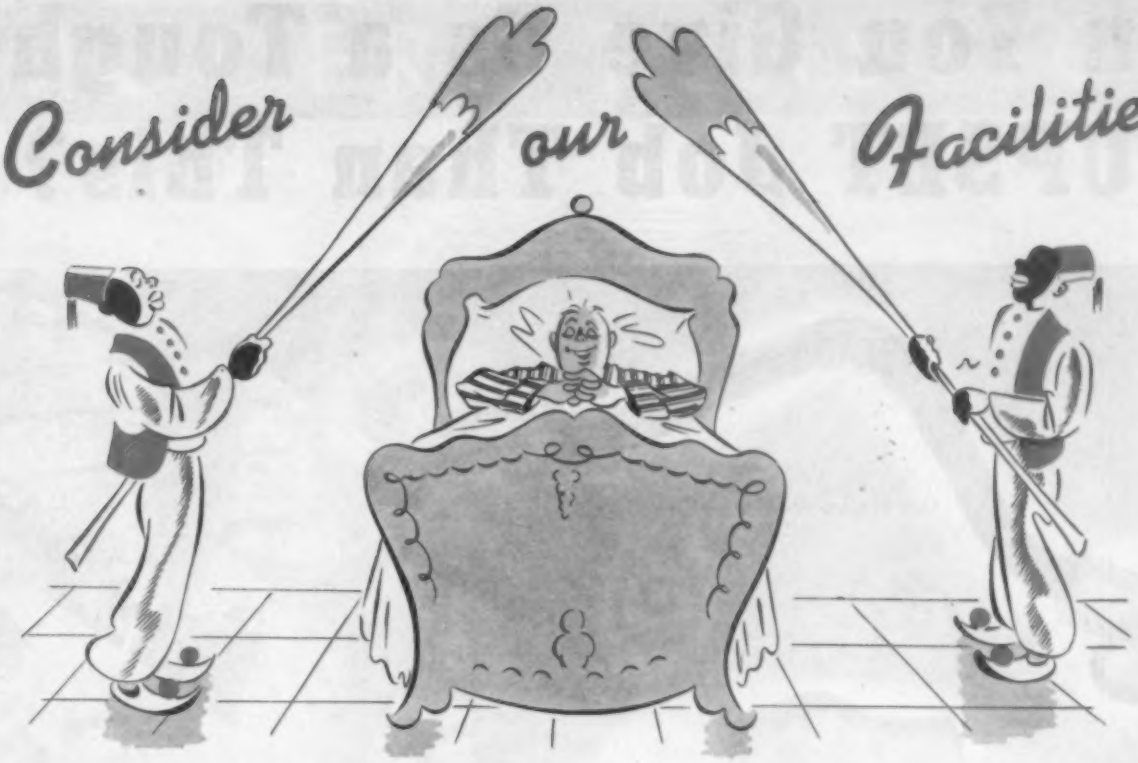
Consider our Facilities



We have talked a lot about what we have accomplished in the way of plastics extrusions. But we have never sat down and really told you about our plant and our organization.

After all, Macoid's pioneering jobs—which translate the processes of plastics extrusions into the requirements of all industries including aviation, automotive, refrigeration, furniture—have to come from someplace!

We think that we have one of the finest extruding plants in the country. The machinery was designed by us and built to our own specifications. Engineering-wise, we have some of the best minds in the world. Here are the men who actually originated the process of modern dry plastics extruding. Not content with being first, they have always strived to be foremost.

As an organization, our career in plastics extruding has been marked by many milestones of successful, unusual applications.

We also do injection molding.

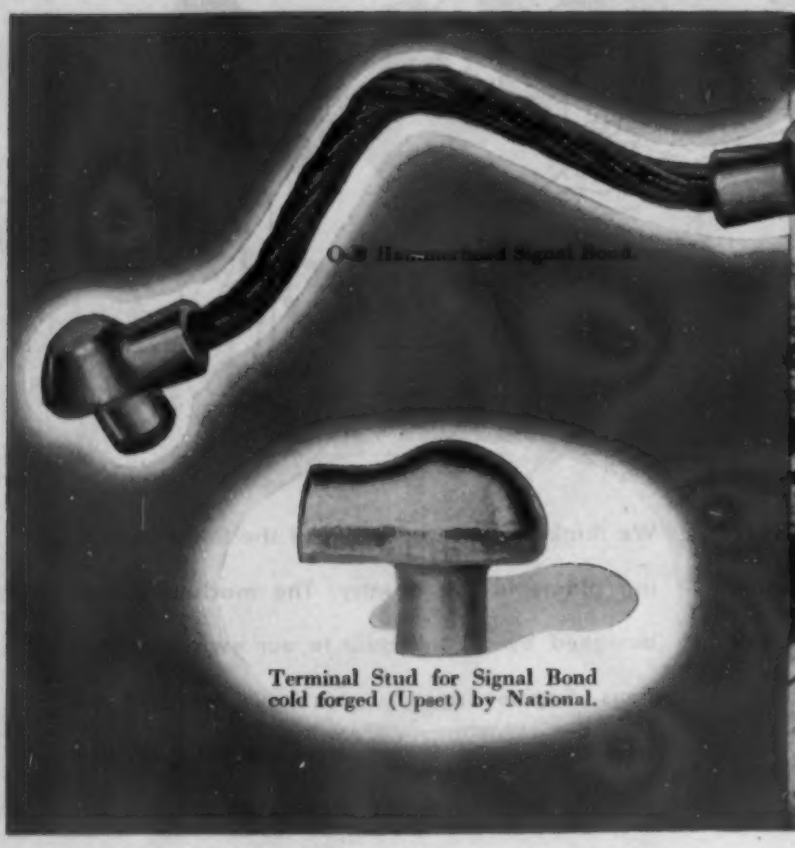
DETROIT MACOID CORPORATION

12340 Cloverdale Ave.
Detroit, Michigan

SOCIETY OF THE PLASTICS INDUSTRY · SPI

ORIGINATORS OF
DRY PROCESS PLASTIC EXTRUSION

Can You Give Us a Tougher UPSET Job Than This?



Terminal Stud for Signal Bond cold forged (Upset) by National.

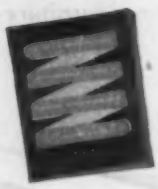
Hammer Man Driving Bond in Rail for Lifetime Service.

Here's a piece of metal that really takes a beating. It's the terminal stud for Ohio Brass Company's Hammerhead Signal Bond. It must withstand first a severe assembly operation in the plant, then a lusty blow on the head when it's driven into the rail, and finally, the constant vibration throughout the lifetime of the rail as the trains thunder over it.

When production needs for this stud could not be met by hot forging, Ohio Brass put it up to National Screw. It was a very difficult part to upset, particularly with the necessity of procuring perfect grain flow and tempering to prevent difficulties in final assembly and reforming. We worked out a method of upsetting from round wire, solving the problem of securing volume while at the same time reducing the cost.

Few upsetting jobs are as tough as this one, but we cite it to show you what unusual things can be done where unusual experience, ingenuity and facilities are at your service.

Have you seen our "Savings" booklet? If not, please write for a copy.



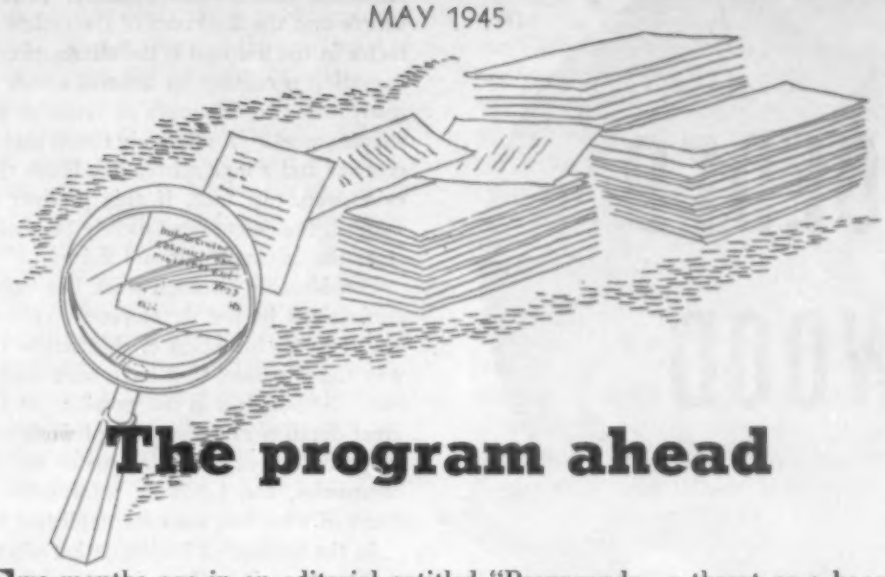
Send for a copy of the "Savings" booklet—brief diagrammatic stories of time and money saved by "National" methods.

National
HEADED AND THREADED
PRODUCTS

THE NATIONAL SCREW & MFG. CO., CLEVELAND 4, O.

MODERN PLASTICS

VOLUME 22 MAY 1945 NUMBER 9



The program ahead

Two months ago in an editorial entitled "Propaganda—a threat or a boost," MODERN PLASTICS magazine sought to direct the attention of the plastics industry to certain conditions which demanded remedial action, to stimulate industry-wide discussion of these problems and to offer for the industry's approval a few constructive suggestions. What started out as a mere analysis of the industry's status developed into a tentative prospectus for action—a 10-point program.

Some of us were hesitant even to outline such a sweeping program and argued that any effort at industry-wide coordination would undoubtedly encounter stiff resistance in many quarters. We realized that some of the demons we were trying to rout were extremely elusive and that it might be presumptuous to attempt to encompass so many aims within the scope of one plan.

The skeptics among us now admit that much of that pessimism has been unfounded. Within a few weeks after publication of the editorial, the response from the plastics industry has been such that the experience alone has been a stimulus to renewed effort. All of us are now convinced that if we had done nothing more than provoke comment and an articulate expression of the industry's thinking we would have accomplished our purpose. The fact that we have been overwhelmed by a flood of varied opinions and demands for reprints is evidence that the industry is aware of the need for a course of action and appreciates the Herculean task ahead.

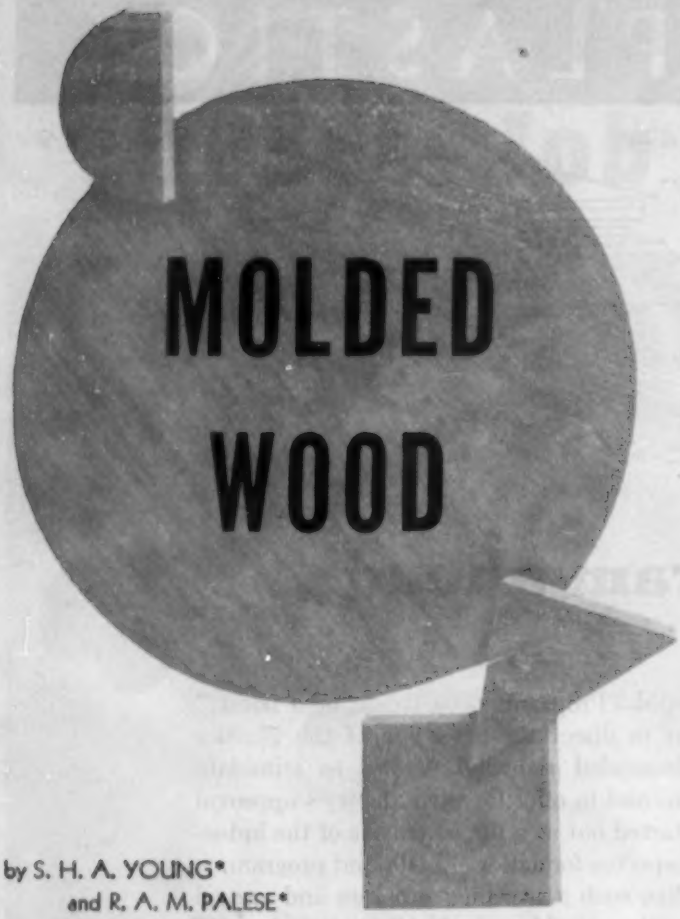
We admit that there have been brickbats as well as bouquets. Some in the industry have advocated drastic measures to achieve desired goals; some have reacted violently against certain or all of the proposals. There has been some duplication of ideas, some similarity in approach and many revolutionary suggestions.

It will take time to study, to interpret and to analyze the opinions which have already reached us and there are many more yet to come. We intend to present both pros and cons, to write as soon as possible a factual report that will indicate the industry's reactions. We shall analyze all suggestions and offer for the industry's further study a summary of what its members have on their minds.

We hope this expression of industry opinion will lead to the adoption of a program of action—modified, expanded and altered to meet the desires of the majority—and bring us nearer to the final goal of clarifying plastics to industry and to the public.

We take this opportunity to invite all our readers who have not yet done so to send in their ideas and suggestions on a program of this type so that our final report will encompass the widest possible expression of opinion.

★ ★ ★



by S. H. A. YOUNG*
and R. A. M. PALESE*

TO many it will come as somewhat of a surprise to learn that the common substance of wood has become very closely allied to plastics, to the extent that it can be molded in dies under heat and pressure, in a way that greatly enhances its natural physical properties and beauty.

While wood in a finely ground condition has for years been used as a filler for certain plastic resins, the resultant product, in comparison with certain other materials, could never be classified as strong. The cellular structure of wood is a very well-engineered product. But when the wood is digested as in paper making, or ground to a relatively fine state, its originally strong structure is then almost completely destroyed.

For a considerable time, researchers have given a great deal of attention to the idea of impregnating wood with synthetic resins, on the assumption that the undisturbed structure of wood would make an almost ideal filler material. To this end, certain impregnating techniques have been borrowed from the well-established wood preserving industry, which has, for a long time, been successfully impregnating railroad ties, fence posts, telephone poles and numerous other products with various wood-preserving chemicals through the use of vacuum and/or pressure.

Compreg, Impreg, Pregwood and similar materials are representatives of the laminated type of molded wood. Such products, which have been successfully used in fan blades, airplane propellers, and a host of other applications, consist of thin wood veneers impregnated with phenolic resin by the immersion process or under vacuum, and finally molded under heat and pressure.

In the impregnation and molding of solid wood to final form for use as brush backs, knife handles, knobs, handles of various types and many other applications, not only is the inherent natural beauty of the wood retained, but the product is rendered water, acid, alkali and heat resistant, and given improved dimensional stability. The process is relatively simple and the final cost of the article is moderate. A large factor in the low cost is the elimination of the costly finishing operation necessary on natural wood. It is also possible in many cases to eliminate as much as 90 percent of the preshaping work. A relatively rough preform develops full mold contour and a high mirror-like finish that is much more than skin deep. In fact, if this product should be dented or marred, the defect need merely be sanded and polished to restore the original color and finish.

Considerable research work has been done by various organizations in the development of molded wood products, and it is the intention of this article to present in a general way the advances that have been made recently toward this end. Although it is not possible, at this date, to discuss in great detail work on specific projects which have been undertaken by our organization under the sponsorship of various companies, the following information should indicate the trend of what has been accomplished to date.

In the method of impregnation wherein vacuum and pressure are used, it has been found possible to thoroughly impregnate relatively large and thick sections. Highly resinous woods such as rosewood and coca bola resist almost completely any attempt at impregnation. A large number of inexpensive woods, however, have been found easy to treat. In woods, penetration takes place in three directions:

1. Longitudinally, or in the direction of the length of the tree.
2. Radially, or in the direction of the radius of the tree.
3. Tangentially, or in the direction of the annual rings.

In the treatment of different wood species, no direct relationship has been found between the specific gravity and the penetration of resin solutions. Some of the denser woods are relatively open pored compared to lighter and less dense woods with finer pore structure.

The size and the number of the resin passages exert a rather marked effect upon the resin penetration. If the longitudinal resin ducts are intersected by the smaller radial resin passages within the wood rays, the penetration is greatly enhanced. Species having small and scarce ducts that are open for only short distances, make penetration very difficult.

Influence of structure on penetration

Those who have been engaged in commercial preservative treatment of wood are well aware of the difficulties of impregnating heartwood. Unfortunately, these difficulties are also encountered when resin solutions are used. However, it may be pointed out that while segregation of sapwood for preservative treatment in large products is, for certain species, impractical at the present time, this difficulty is largely by-passed in molding resin-impregnated woods because, thus far, such parts are relatively small. To this may be added the fact that in small preforms, particularly those with considerable exposed end grain, sufficient resin solids are deposited to insure sound moldings. From this, it must not be concluded that selection of sapwood may be entirely ignored. On the contrary, selection is a sound procedure.

The structural difference that affects the penetration of materials in both hard and soft woods is the difference between heartwood and sapwood. This difference lies in the fact that the sapwood is living and takes an active part in tree growth while the heartwood is inactive. During the transition from

* President and Chief Chemist, respectively, Engineering Associates.

sapwood to heartwood, changes usually occur in the cellulosic structure of hardwoods, which may become practically or completely closed with pithlike growths called tyloses, or with gum. In the conifers, the openings in the tracheid walls may undergo changes that make them highly resistant to the passage of liquids. The resistance of the heartwood to penetration depends largely on the presence or absence of tyloses or other obstructing materials, such as gums and resins, in the vessels. However, not all heartwood is difficult to penetrate; in fact, some species have heartwood that is quite easy to penetrate. Among the hardwoods this group includes basswood, beech, black and tupelo gum. Among the softwoods are ponderosa and bristle cone pine.

The hardwoods contain cells which are set end to end and serve for the conduction of sap. The vessels or pores form more or less continuous passages. The softwoods have elongated cells called tracheids (or fibers) which have closed ends. Liquids pass from one tracheid to another through bordered pits, which contain minute perforations and are most numerous near the tracheid ends. Thus in hardwoods, penetration is more or less dependent upon the open or closed condition of the pores or vessels while in softwood, penetration largely depends upon the permeability of the cell walls.

Preparation of wood for treatment

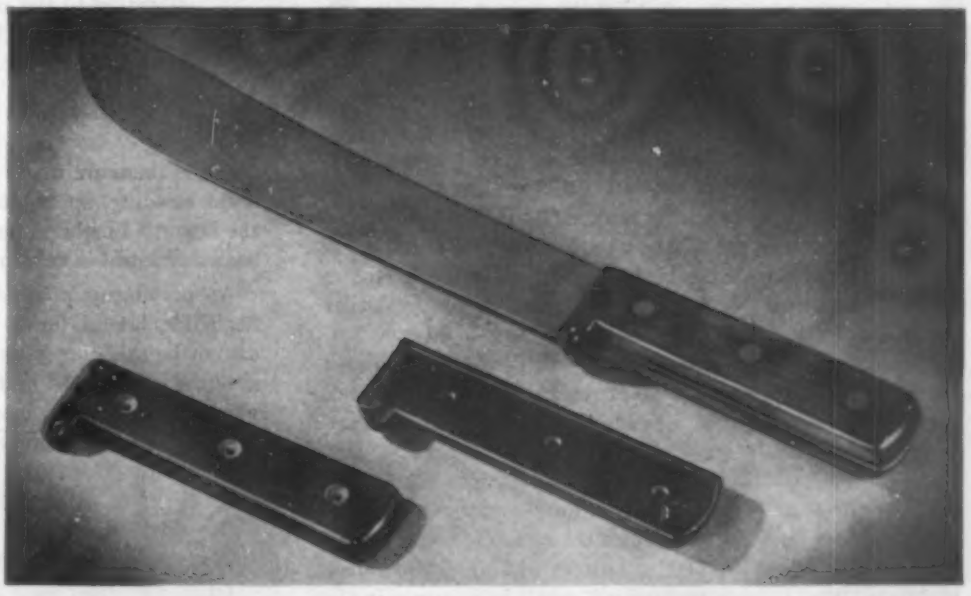
To obtain the best results from the impregnation and consequently the best distribution of the resin, it is necessary to dry the wood before placing it in the impregnation chamber. To achieve this, the wood should be dried to a point below its fiber saturation point using a drying oven or kiln where the humidity can be controlled so as to eliminate checking and warpage. The fiber saturation point is identified as that stage at which the cell walls are saturated and the cell cavities are free from water. The time and temperature required for the drying will depend upon the type and species of wood as well as its moisture content. For best results, a blank should be cut to the general shape of the finished article with enough finish provided to allow for some distortion resulting from impregnation.

Impregnation

Vacuum stage—This stage follows oven drying. The wood is placed in a chamber which is then sealed. Next a vacuum is applied and maintained at from 23 to 28 in. for 30 to 60 minutes. The function of this step is essentially the removal of the air from the interstitial space in the wood. As would be expected, this procedure results in easier impregnation and greater resin pickup at the time when the wood is subjected to the resin solution.

Pressure stage—After evacuation, resin is admitted to the sealed chamber and pressure ranging from 150 to 300 p.s.i. is applied and maintained from 1 to 3 hours. The blank that is being treated should be free from knots, worm holes, cracks and other defects. Most important, it should be free from

1 ALL PHOTOS AND DRAWINGS, COURTESY ENGINEERING ASSOCIATES



1—The smooth surface produced by the molding of wood is evident in these knife handles. 2—Shown from left to right is a phenolic-impregnated hard maple preform, a section through a phenolic cypress molding in which the wavy grain is natural and, finally, a molded phenolic-hard maple knob

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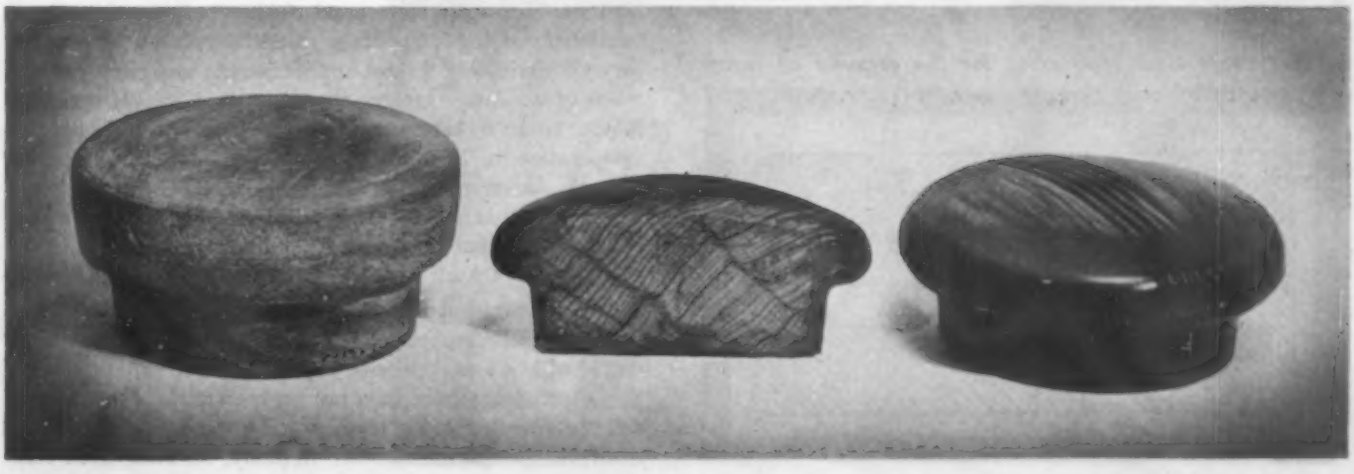
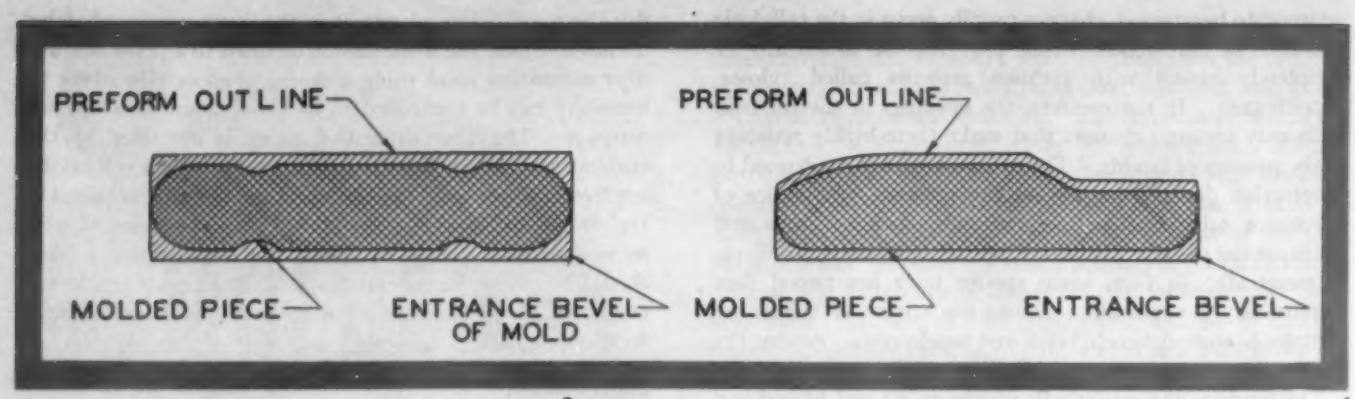




3 4

3—In preparing preforms, it must be borne in mind that impregnated wood has negligible flow in the mold. However, where a major variation in section thickness is not involved, it is only necessary that the basic contour of the part be followed. 4—When the part that is being molded lacks marked variations in form, uniform reduction of the section to obtain the desired compression factor is all the preshaping required on the preform

heartwood, unless the wood is of a species in which the heartwood is readily impregnated.

Precuring

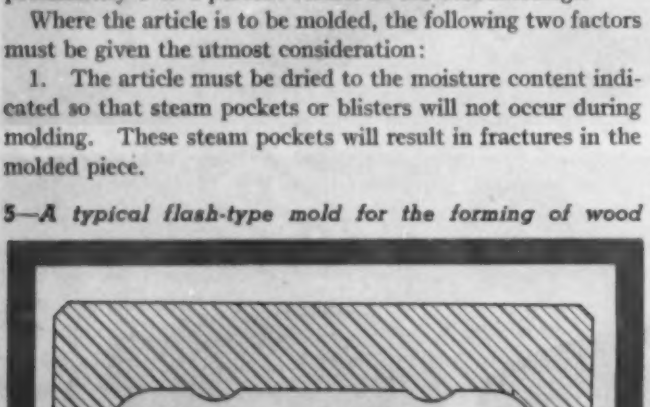
Air drying—Immediately after their removal from the impregnation chamber, it is necessary to air dry the treated pieces. Here again the time required for the air drying will depend upon the wood species, the size of the pieces and the amount of resin solution absorbed. It is, therefore, advisable to maximize the air drying time. It has been found that a 12 hr. air dry is adequate for most woods depending, of course, upon the surface area-volume ratio.

Oven drying—This step follows immediately after the air dry. Herein the samples are either prepared for molding or cured to their final state depending upon the demands of the article under consideration. Where the article is not to be molded, the oven curing resolves itself to the drying of the wood for a long period and at a temperature suitable for polymerization of the resin. Where the article is to be molded, oven drying is used to remove moisture and volatiles to a point desirable for proper molding. As is to be expected, the time and temperature required will depend upon wood species, size of blank and type of resin. It has been found, using phenolic resin, that a residual moisture content of approximately 3 to 4 percent results in the best moldings.

Where the article is to be molded, the following two factors must be given the utmost consideration:

1. The article must be dried to the moisture content indicated so that steam pockets or blisters will not occur during molding. These steam pockets will result in fractures in the molded piece.

5—A typical flash-type mold for the forming of wood



2. The wood must not be excessively precured by too high a temperature or too long a time in the oven. Oven precuring lessens resin flow during molding, thereby precluding a good finish and fidelity to mold detail.

Care must be exercised to avoid placing the wood in the drying oven before it is adequately air dried, for if the wood contains too much moisture, two undesirable conditions arise.

1. Rapid evaporation of the water will result in resin migration to the surface from the inner sections.
2. Checking and cracking will occur if adequate humidity control is not exercised.

Molding

While there are many factors common to both plastic and wood molding, special techniques have been developed for the latter. Furthermore, certain special design factors have been developed in relation to tool design.

As previously pointed out, impregnated wood develops negligible lateral flow. Furthermore, by any standard, it cannot be said to possess "flow" in the same sense as in the molding of standard urea and phenolic compounds. Fundamentally, a simple compression or reduction in section takes place in the mold during which polymerization is completed, permanently "freezing" the compressed wood structure into final position. Under these conditions, the resin itself is highly flowable, which is believed to result in further permeation of the cellular structure.

Of major importance is the matter of compression factor. This would roughly correspond to the "bulk factor" of conventional molding compounds. Generally, it is neither necessary nor desirable for most applications to mold impregnated wood to a density greater than 1.30 to 1.38. If a part is molded to, let us say, a density of 1.4, it will, if subjected to a temperature of 375° F. for an appreciable time, develop heat checks or crazing on the surfaces. This will not occur if the density is held to below 1.34. Below the latter value, it is believed that the molded section retains sufficient elasticity to adapt itself to the thermal stresses involved.

The compression factor varies with the different species. Obviously, the compression obtainable in a wood such as maple will be less than with poplar, redwood or cottonwood. While complete studies have not yet been made of the molding compression factor for many wood species, some data are available for specific woods. Actually, no final, fixed com-

pression factor can be assigned even to a specific wood because of the variables present, even though specific gravity (molded) is specified. In spite of these limitations values, experimentally derived, can be assigned which will serve as a definite guide for certain species. Birch and hard white maple, for example, mold very well at a compression value of 25 percent of the original preform thickness. For soft white maple, a value of 28 to 30 percent has been found satisfactory; for basswood and ponderosa pine 33⅓ percent. On the other hand, redwood can be satisfactorily molded at a value in excess of 50 percent.

It might be well to mention that unlike conventional plastic materials, an impregnated wood preform may very readily be designed so as to develop different molded densities at different locations in the piece. This may very well be of considerable importance where the use of ordinary wood screws as an assembly means would be desirable. It must be emphasized, however, that the design of the part must, in these cases, be carefully considered.

Molding temperatures—The temperatures used in the molding of impregnated wood will, of course, depend upon the type of resin used. Urea, melamine and phenolics lend themselves readily to the impregnation method. In molding urea-wood materials, mold temperatures should not exceed 280 to 285° F. The use of materially higher temperatures than this is attended by a progressive deterioration of the resin accompanied by a very unpleasant odor. Melamine may be molded in the temperature range of 300 to 305° F. with satisfactory results. For phenolic resins, consistently good moldings are obtained at temperatures of 320 to 340° F.

Molding time—This is of considerable interest to prospective molders of impregnated wood because of its economic importance. Thus far, many different parts have been experimentally molded by our company, almost all of them characterized by relatively thick sections. Generally speaking, the molding times for impregnated wood are comparable to the time required on sections of equivalent thickness for conventional compounds. However, mold closing time on the former is somewhat longer than is the case with conventional compounds, due to a greater rigidity in the preform as well as a lesser flow value.

There are two promising possibilities regarding the molding time factor, both of which have thus far, been experimentally successful.

1. The use of electrostatic preform preheating, which is primarily effective in greatly reducing mold closing time as well as total molding time.

2. The use of a split molding cycle. This may be explained as a method whereby the preform is compressed in the mold, retained there only long enough to develop form and surface finish, after which it is removed from the mold, and cured to completion in an oven.

Relative to the first method, enough research work has been completed to confirm the validity of this method as applied to resin-wood systems. It effectively overcomes the principal barrier to a fast curing cycle—the insulation value of a cellular structured preform. From this standpoint, it may be said that the resin-wood preform is at somewhat of a disadvantage as compared to a comparable preform made of

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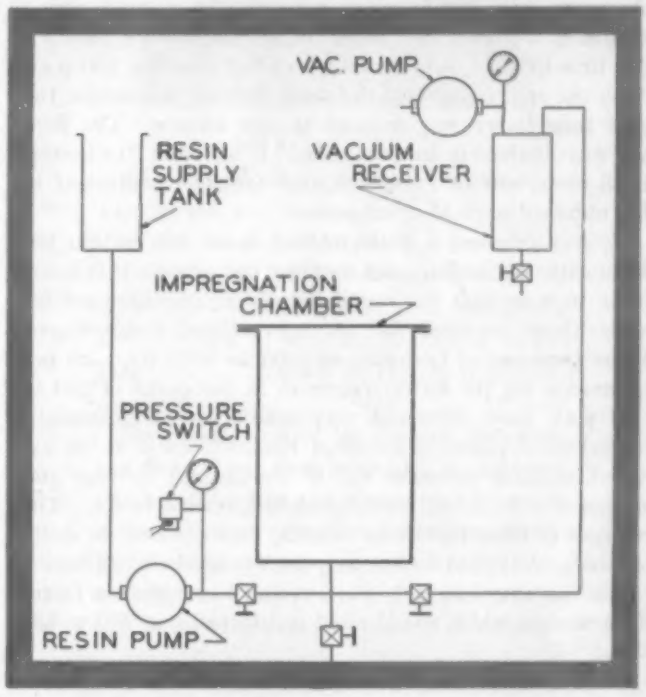

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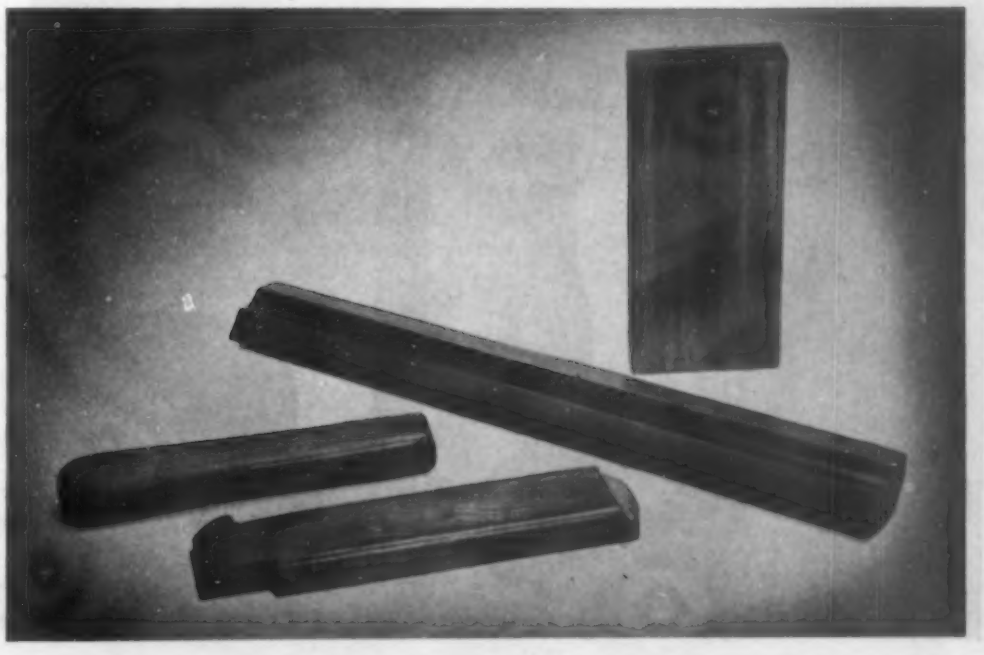


***6**—A schematic diagram of an impregnating system*
***7**—A group of typical phenolic-birch and phenolic-hard maple moldings. The parts are as smooth as glass and the apparent irregularities on the surfaces of the parts are due to grain configurations*

conventional compounds. For the same reason, it also can be stated that radio frequency heating is relatively more effective with a resin-wood preform than with its conventional counterpart.

Concerning the second method—the split molding cycle—laboratory experience has shown this method to be very practical *where extreme accuracy in the molded piece is not required.* The use of this method for conventional molding materials would result in pieces of very poor quality. In the resin-wood piece, however, it was learned that springback in the piece after removal of molding pressure was negligible upon reaching a *critical minimum* combination of pressure, temperature and time. As is to be expected, this condition will vary with the type of resin used, wood species and preform size.

At the present time, volume production of a deeply embossed circular plate element is being undertaken after the satisfactory adaptation of the split-cycle technique in the laboratory. In this specific instance, the normal curing conditions for the piece[1] were: mold temperature 280° F.; cure time in mold, 6 to 7 min.; molding pressure, 500 p.s.i. Using the split cycle with the same molding conditions, the mold time factor was reduced to one minute. The final cure was obtained in an oven at 265° F. for 15 to 20 minutes. In all cases, surface finish was approximately equivalent to that obtained in mold cured pieces.

Molding pressures—While molded wood falls within the classification of high-impact molding compounds, it is interesting to note that the required molding pressures are far below those required for its conventional counterparts. Where pressures of the order of 2000 to 6000 p.s.i. are not uncommon for the latter, pressures in the range of 200 to 1000 p.s.i. have produced very satisfactory high-strength molded-wood pieces of excellent quality. As is to be expected, molding pressures will be conditioned by type and content of resin, wood species and compression factor. The influence of these factors on molding pressure may be easily deduced. A typical "reference point" would be birch having a resin content of 25 to 30 percent and a compression factor of 25 percent which would mold satisfactorily at 500 to 550 p.s.i. In the absence of unusual requirements, a nominal top molding pressure value of 1000 p.s.i. has been found to be satisfactory.

Preforms—Brief reference has previously been made to preform requirements. To make a restatement, impregnated wood has negligible flow in the mold. Hence the accuracy of the preform in "planform" is of considerable importance. However, viewed in elevation, it is only necessary that the basic contour be followed where a major variation in section thickness is not involved. This condition is illustrated in Fig. 3. It is well to remember that preform and mold must be designed both to insure pressures normal to all surfaces of the preform, and not to depend at all on the development of pressure through utilization of flow properties.

In Fig. 4 is shown a section through a molded piecea nd its preform where the lack of marked variation precludes the necessity of preshaping the preform, other than reducing the section uniformly to obtain the desired compression factor.

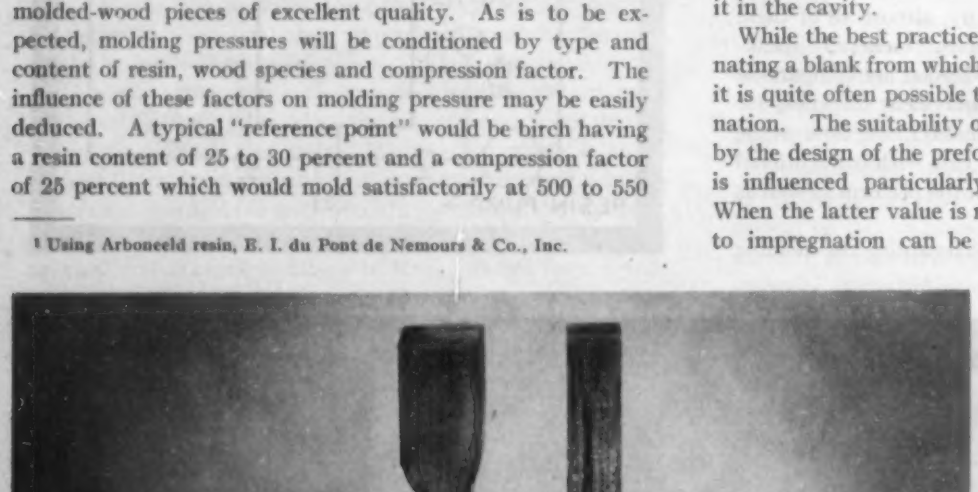
The process of impregnating and drying a preform blank (particularly in the case of phenolic resin) develops a surface color, slightly darker than the surface of a cut section of the same blank. This color differential would be discernible in the finished molding (compared to a molded cut section) unless this surface deposit is lightly sanded prior to molding.

Saw marks will be molded flush with the surface of the piece. However, it is desirable to sand these out of the preform surface to a reasonable extent to prevent their presence in the finished molding.

In section, the preform edge first entering the mold should be just small enough to enter the mold, while the section of the preform adjacent to the mold "cut off" should be fairly tight. In no preform molded to date was it desirable to make it small enough in order to preclude the use of press pressure to bottom it in the cavity.

While the best practice developed to date involves impregnating a blank from which a preform is machined after drying, it is quite often possible to machine a preform before impregnation. The suitability of the latter technique is conditioned by the design of the preform and its companion mold. This is influenced particularly by the draft angle permissible. When the latter value is relatively large, some distortion due to impregnation can be readily (*Please turn to page 196*)

[1] Using Arboneeld resin, E. I. du Pont de Nemours & Co., Inc.



***8**—The piece in the left background shows the reduction in section due to molding a phenolic-poplar preform at a pressure of 1000 p.s.i. The part in the right foreground indicates the uniformity of penetration in a 1-in. section of ponderosa pine impregnated with urea-formaldehyde dyed red. In the foreground, left to right, natural ponderosa pine blank; impregnated and cured ponderosa pine preform; molded urea-formaldehyde-ponderosa pine hand wheel and phenolic-ponderosa pine hand wheel*

The realities of the future*

by CARL W. SUNDBERG**

THE other day an acquaintance posed this question: "Which of the automobile companies plans to come out after the war with that new transparent plastic top?"

Unfortunately, this man wasn't joking. Unfortunately, his question typifies what far too many people are expecting of plastics in the near future. As rumors and reports of amazing advances in all industry have filtered through the screen of military secrecy, they have been pounced upon by the postwar prophets and translated into promises of every type of super-super product. Because there has long been magic in the word "plastic," newspaper and magazine writers have had a field day developing plastics into the miracle material of the ages.

We designers are guilty too—guilty of using each new development announced by the plastics industry up to and beyond the fullest limits of its possibilities. Always casting about for new ideas, we have sometimes given in to the temptations offered by plastics—particularly some of those mysterious things war production has been doing with various materials and about which we know a little but not enough. Because the pictures we have drawn are sensational and good to look at, they have been published and have contributed to the misleading of the public. But we have our excuses. Industrial designers are artists who work, not with paint, charcoal, clay or music, but with the materials from which the tools for living are built. By comparison with the media of other artists, that of the industrial designer is static and flexible only insofar as man is able to cut, hammer, cast and polish it at high speed. Because it is cheaper, a radius is often used where a sharp corner would be preferable. Because it is faster, a sharp corner is sometimes used where a radius would look better. This part can't be die-cast because it is impractical. That part can't be stamped because it is just plain impossible.

These are hard limitations with which to fence in the imagination of a creative person. So, when offered plastics in all their beauty and versatility, designers turn to them naturally and easily. This is good for the plastics industry since important uses for many plastics have grown from ideas worked out on drawing boards—and there will be many more of these in the days to come.

The harm is done when the public is presented with unproved ideas in the name of promises for the immediate future. The result is a widespread misconception of just what plastics can and cannot do, at present—a condition which can do great damage to the plastics industry. At the same time, this over-enthusiasm fosters its equally dangerous opposite extreme—ultraconservativism.

Plastics engineers—always conservative, as are all members of exact professions—have, in self-protection, erected a barrier of ultraconservativism about their work. They have witnessed so many unbridled flights of imagination into the amazing future plastic world, that they have decided to protect their interests and those of the industry by asserting nothing is possible until it has already been done. It has come to the point where conscientious members of the industry are apparently so concerned about the publicizing of impossible ideas that they are beginning to overemphasize the limitations of plastics.

A disillusioned consumer public, however, will be a serious handicap for an industry whose opportunity for postwar expansions is seemingly unique. While the industry is in its infancy and can expect to suffer growing pains, serious sales resistance need not be one of the difficulties if future customers are not now misled.

Of equal importance to the plastics industry is its own current frame of mind. It should make every effort to control what is published about its products but, in preparation for the days when its products are no longer strictly allocated to war items, it must encourage flights of fancy. The history of all progress is punctuated with seemingly impossible dreams that later materialized into some of our greatest advances. Dreams will continue to be necessary to normal progress, and many applications of plastics and the techniques for handling them will start with completely impractical ideas. Don't discourage the dreamer. Just try in every possible way to discourage the publication of his fancy as fact.

As industrial designers charged with the responsibility of suggesting the *right material for the right job*, we subscribe to a

CARL W. SUNDBERG

Carl W. Sundberg started his designing experience in the custom automobile field for Dietrich Body and later had a hand in the designing of production bodies for General Motors and Budd. He was one of the pioneers in plastics designing and is responsible for many of the early plastics applications.

Mr. Sundberg and his partner, Montgomery Ferar, have been engaged in industrial designing for a period of about twelve years. Although their firm is engaged largely in war work at the present, it numbers among its clientele many leading manufacturers and merchandisers of consumer goods.

* Presented before Detroit Society of Plastics Engineers on Feb. 22, 1945.
** Sundberg-Ferar, industrial designers.

ALL COLOR RENDERINGS, SUNDBERG-FERAR

1—*An automobile trailer that could be used as a rowboat or as the shell for an outboard motorboat is a possible future application for the low-pressure molding technique since the manufacture of an item of this nature does not dictate high-speed production methods. This conception of a "boatrailer" envisions a unit that could serve as a carry-all, as a camp bed or as living quarters in a dry camp*

course down the middle of the road. We must dream because it is our business to create. But we must translate our dreams into workable ideas, salable products.

We like to use plastics because they are workable; their inherent beauty lends itself to distinctive treatment. There are countless new developments to be explored for ideas. Where a well-chosen plastic meets the physical requirements, it is almost certain to surpass other materials esthetically. We have studied several products in the light of recent findings in the plastic field and have applied to their design various materials and methods which, if not altogether practical at the present moment, are well within the bounds of feasibility.

Perhaps some day in the dim future automobile bodies will be made of some plastic material, but the accomplishment of this is so remote it is deserving of only "possibility" thinking. Some of our contemporaries have prophesied the production of bodies by low-pressure molding of plastic-impregnated fibrous material of various kinds. This is a spectacular suggestion which, in the light of the remarkable wartime uses of the technique, seems reasonable at first glance. However, without going into technicalities, it is necessary only to point out that the optimum molding cycle is far too slow to keep pace with automobile production.

Transparent noses, gun turrets and blisters on war aircraft have also proved too great a temptation to many prophets. They have inevitably transposed them to the automobile of the immediate postwar future in the form of windshields, windows and tops. Here again, many technicalities hamper this eventuality. Too, we need only realize that the hardest of transparent plastics have been tested without success for this purpose, and we rule it out.

Of interest to the motorist

What *are* some feasible new ideas for plastics in the automotive field? The possibilities for their increased use in interiors are almost limitless. Even the use of prewar materials and methods have not been exploited to their limit in decorative treatment of dashboards, instrument panels and hardware, and late developments will surely broaden the opportunities in this direction. Important strides have recently been made in the treatment of fabrics. Certainly there is room for improvement in automobile trim and upholstery, and just as surely the plastics industry will supply the ideal material with all the beauty, texture and long-wearing qualities that are necessary to the lasting success of this application.

Our Navy is making good use of a newly perfected glass fiber material in building fireproof bulkheads. We feel sure there is an application for this and similar materials in auto-

mobile production. In Fig. 2 we have illustrated its use as a cowl, dashboard and instrument panel, possibly molded in one piece. The opportunities for decorative treatment and the solution of many construction problems are obvious in this suggestion.

Boat building is perhaps the most tradition-bound of our large industries. Yet it appears that the maintenance of many of these traditions has been due to the limitations imposed by boat-building materials down through the ages. The wooden hull must perforce be hand-fashioned by master craftsmen to achieve functional shape; each craftsman has his own ideas concerning the best shape. In many cases strength must be sacrificed in order to achieve a marked reduction of weight.

Here, then, is a chance for the plastics industry to move in with new materials and a worth-while contribution. The low-pressure molding of large hull sections—or the entire hull—while slow compared to the stamping of the automobile bodies, will still be much faster than the labored hand-building of wooden boat hulls. Scientifically designed shapes could be achieved and standardized. Rounded bows for cushioning the slap of rough seas—virtually impossible of achievement in a wooden hull—could be easily molded in.

Much study should, and will, be given to the perfection of the ideal material for this use. Perhaps this too is the place for glass fibers. There are many plastic materials which have advantages over wood with respect to lighter weight, no leaks, no dry rot, increased strength, proof against termites, hard finishes and comparable cost.

Molded boat and trailer bodies

Molded boat hulls will suggest the introduction of hitherto impossible improvements in shipbuilding. The use of outboard motors has been developed to a high degree of efficiency during the war, and many of our personnel craft and landing barges are powered by removable engine units. Many traditional trouble-making features could be eliminated by making use of the same principles in the building of pleasure craft. An entire engine housing, molded in one or two sections, would fit snugly into a stern designed to accommodate it. Easily detachable, it could be removed for servicing, storing and transporting. More and cleaner passenger space would be provided, and the elimination of oily bilge would be a special feature.

Picture an automobile trailer (Fig. 1) that could be used as a rowboat or outboard motor shell. The manufacture of such an item would not dictate high-speed production. Hence the low-pressure molding of a suitable material in beautiful and functional shapes could result in the creation of a truly presentable automobile trailer. In our conception of the "boatrailer," the unit also serves as a carry-all and might even be used as a camp bed or complete high and dry camp living quarters.

Plastics will find their way further and further into the construction and decoration of buildings. Prefabrication was fast becoming an important factor in the building industry before the war, and its importance is bound to increase as we feel the effect of the postwar demand for low-cost housing, shops, gasoline stations and other standardized buildings. Plastic-bonded woods and other laminates can take a leading part in this field. Here, also, many uses for treated fabrics will be discovered as their production becomes more diversified. Electrical fixtures, plumbing and insulating materials of plastics will, without doubt, find more and more acceptance after the war is over.

The bathroom and kitchen are fertile territory for exploitation by the industry. Today we have shower curtains, door-pulls, fruit knives, counter tops and a thousand plastic gadgets—some good, some bad. Tomorrow will see improvements on all of these items and perhaps the introduction of plastic medicine cabinets, plumbing hardware, lavatories, prefabricated kitchen furniture, and even the kitchen walls. These and many, many other building ideas are good possibilities for the near future.

Radios, always a popular and very logical field for plastics, will make more and better use of many of these materials.

2—The glass-fiber melamine resin panel board that is now being used by the Navy for instrument panels and bulkheads may well be used in the postwar as a cowl, dashboard and an instrument panel

3—Children's toys suggest many possible applications for plastics. For example, use of low-pressure molded plastics in the main structures of this tricycle, hand-car and all-purpose sled adds greatly to their attractiveness and strength while reducing their over-all weight

and the eventual combination of television with radio and phonograph will result in a brand-new product. For a time its market will be small and its price high; it will demand large, good-looking cabinets. Could this be another open door to the low-pressure molders? We think so.

Plastics in toys

Low-pressure molded plastics in the main structures of toys have added greatly to their attractiveness, strength and lightness. The tricycle shown in Fig. 3 has skirted fenders and a deep channeled main strut fairing into the rear cross member—combining all these components of the present-day toy into a monocoque unit on which the rear wheels are mounted. The fork of the front assembly is actually the fender which shrouds the wheel. This fender has a large diameter roller-bearing race mounted on either side in which the wheel disk shoulders ride. The pedals are mounted directly on the disks.

The old stand-by, the Irish Mail or hand-car, is handled similarly to the tricycle in that the skin is actually the structure. This construction serves to eliminate much assembly work. Driving mechanism, steering gear which, incidentally, is foot controlled, and wheels are mounted directly to this main structure—reinforcements being used at points of great stress. These metal parts lead a dual life, being decorative as well as functional.

The last toy shown in Fig. 3 is an all-purpose sled serving as a belly-flopper, or bob sled. It has two main parts. The forward runners are molded in one piece and mounted on the main body of the sled. A large polished chromium ring serves as the steering wheel and is spring loaded. Steel rims or shoes are applied to all runners.

We are not plastics experts but, as vitally interested outsiders, we are keeping a close watch on the progress of the industry. We have seen plastics misused through misinformation. We have seen them misrepresented by unscrupulous manufacturers. We have seen inferior products offered in the name of "wartime substitutes." In a measure we feel responsible for public misconception of the magic of plastics resulting from spectacular world-of-tomorrow prophecies made by some members of our own profession. We want a share in the development of the plastics industry, having every confidence that its scope will increase and a sincere hope that it will grow solidly. We intend to continue recommending its use wherever good judgment indicates.

We will undoubtedly dream about plastics and will make suggestions for wild new uses because that is our business and in that direction lies progress. But they will only be suggestions for discussion, experimentation and development behind closed doors of research. At the same time, members of the plastics industry must assume responsibility for keeping designers and development engineers informed on advances in their fields.

We do not foresee the early perfection of low-pressure molding as a mass-production method. With a return to a peacetime economy, this technique will automatically seek a level of use in the manufacture of low-production, high-priced, virtually custom-made goods. Undoubtedly its molding cycle will be speeded, but even then its superiority to metal stampings will have to be established.

We do not think of plastics in general as a material destined to revolutionize all manufacture. Nor do we think of it as a substitute. It is a basic material with certain definite advantages and certain definite limitations. People accept the fact that some articles are made of steel because they are much better made of steel. They naturally accept wood where it is obviously put to its best use. They must be educated to the same thinking about plastics. Their misconceptions must be corrected. Now, while the public imagination is captured by the very word, "plastics," is the time for the industry to establish itself with dignity as the producers of a material that will occupy its rightful place in the scheme of things—a material that does not attempt to push aside metals, wood, cloth and paper; a material that is not a substitute but will do some jobs better; a material which, in its own right, stands side by side with other basic materials as another, and newer, medium from which to build the things we need and want.

Cellulose plastic products—1942 to 1944

IN June 1942, publication of statistics on cellulose plastic products was discontinued for reasons of national security. While these restrictions have been relaxed, it is still deemed necessary to withhold publication of production data for recent months.

Data are based on the reports of 15 manufacturers. This represents practically the entire industry. Nine manufacturers make cellulose nitrate products, six make cellulose acetate products and ten make cellulose acetate molding composition. Beginning with October 1943, data are included for two companies which produce cellulose acetate molding composition from scrap material. While these companies were in operation prior to October 1943, comparability of the data is little affected. In that month, they made no shipments and accounted for only 2 percent of total molding composition production. One additional company reported cellulose acetate sheets, rods and tubes for the first time in November 1943. The production of this company is so small that comparability is unaffected.

The production and shipment and consumption figures represent data reported by prime manufacturers of cellulose plastic materials and include no data for plastic molding companies which manufacture products from purchased material. This results in some understatement of the data for cellulose acetate sheets, rods and tubes. Manufacture of these products from purchased material, however, is reflected in the data here shown for shipments of cellulose acetate molding composition. The statistics shown for sheet forms do not contain data for safety glass sheeting. They may, however, contain data for some wrapping material. This can be attributed to the fact that the report form does not specify that such should be excluded.

TABLE I.—CELLULOSE PLASTIC PRODUCTS

Year and Month	*Nitrocellulose production*				*Cellulose acetate production*			*Cellulose plastics, total production*
	Sheets	*Rods*	*Tubes*	*Total*	*Sheets, rods and tubes*	*Molding composition*	*Total*	
	pounds	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*	*pounds*
1943	8,929,257	4,280,853	832,238	14,042,348	10,163,467	44,222,714	54,386,181	68,428,529
1942	10,422,370	3,662,075	1,044,381	15,128,826	7,453,307	40,792,518	48,245,825	63,374,651
1941	10,892,557	3,979,588	1,626,874	16,499,019	6,218,151	30,716,617	36,934,768	53,433,787
1940	8,154,492	2,852,477	908,321	11,915,290	8,887,237	14,962,813	23,850,050	35,765,340
1939	9,551,548	3,001,397	820,227	13,373,172	9,140,907	11,654,928	20,795,835	34,169,007
1938	6,616,787	2,237,395	633,744	9,487,926	6,830,506	7,394,291	14,224,797	23,712,723
1944								
January	791,671	409,823	73,625	1,275,119	798,925	4,040,660	4,839,585	6,114,704
February	920,565	450,050	72,486	1,443,101	721,952	4,213,788	4,935,740	6,378,841
March	931,996	459,720	76,604	1,468,320	646,137	4,482,339	5,128,476	6,596,796
April	947,496	431,395	95,746	1,474,637	676,416	4,878,333	5,554,749	7,029,386
May	882,587	484,628	89,640	1,456,855	762,307	5,204,868	5,967,175	7,424,030
June	907,405	448,191	113,085	1,468,681	704,136	4,860,128	5,564,264	7,032,945
July	726,664	381,927	89,527	1,198,118	736,111	4,517,606	5,253,717	6,451,835
August	894,642	396,356	91,748	1,382,746	730,922	5,007,831	5,738,753	7,121,499
Total 8 mos. 1944	7,003,026	3,462,090	702,461	11,167,577	5,776,906	37,205,558	42,981,459	54,150,036
Total 8 mos. 1943	5,702,184	2,776,426	552,171	9,030,781	6,978,735	27,809,158	34,787,893	43,818,674
Total 8 mos. 1942	7,463,270	2,688,542	752,159	10,903,971	4,585,254	27,628,844	32,214,098	43,118,069

A redesigned compass

1

OFFICIAL PHOTO, U. S. ARMY SIGNAL CORPS

1—Although mobile equipment for the Armed Services is designed to withstand the roughest terrain and the most stormy of seas, it must still carry highly sensitive mechanisms to chart its course. These compact M-6 compasses, while yet retaining all of the precision of their more bulky predecessors have been developed to effect a considerable saving of valuable space

THERE is no smooth and easy path for the mobile equipment of the Army and Navy. Jeeps, tanks, tank destroyers, ducks, landing craft and similar units are expected to endure the most severe handling while in service and keep on functioning. This throws a tremendous burden on manufacturers of such sensitive auxiliary equipment as the M-6 compass in which deviation is held to less than one degree.

This newly approved compass, produced entirely from thermoplastic materials except for a few small brass parts and one aluminum piece, is the result of more than two years of development work carried on by the Sherrill Research Corp. in cooperation with engineers of the Engineer Board at Fort Belvoir and Army Ordnance in Washington and Detroit. Weighing but 15 oz., it replaces a Sherrill compass, known as the AEG-1 which weighed 3 lb., and another 9-lb. compass. By the adoption of this newly redesigned instrument, the Army and Navy have accomplished three things.

1. They have saved valuable space in mobile equipment, where every inch of inside room is at a premium, by virtue of the more compact and efficient design of this compass.

2. They have reduced by several million man-hours the machine time consumed in the finishing and assembly of these compasses and, at the same time, saved large quantities of brass. Production has been speeded up so that more of these plastic compasses are assembled by the Sherrill Research Corp. in one day than another factory, making a metal-type instrument, could turn out in a two-week period using a comparable number of employees.

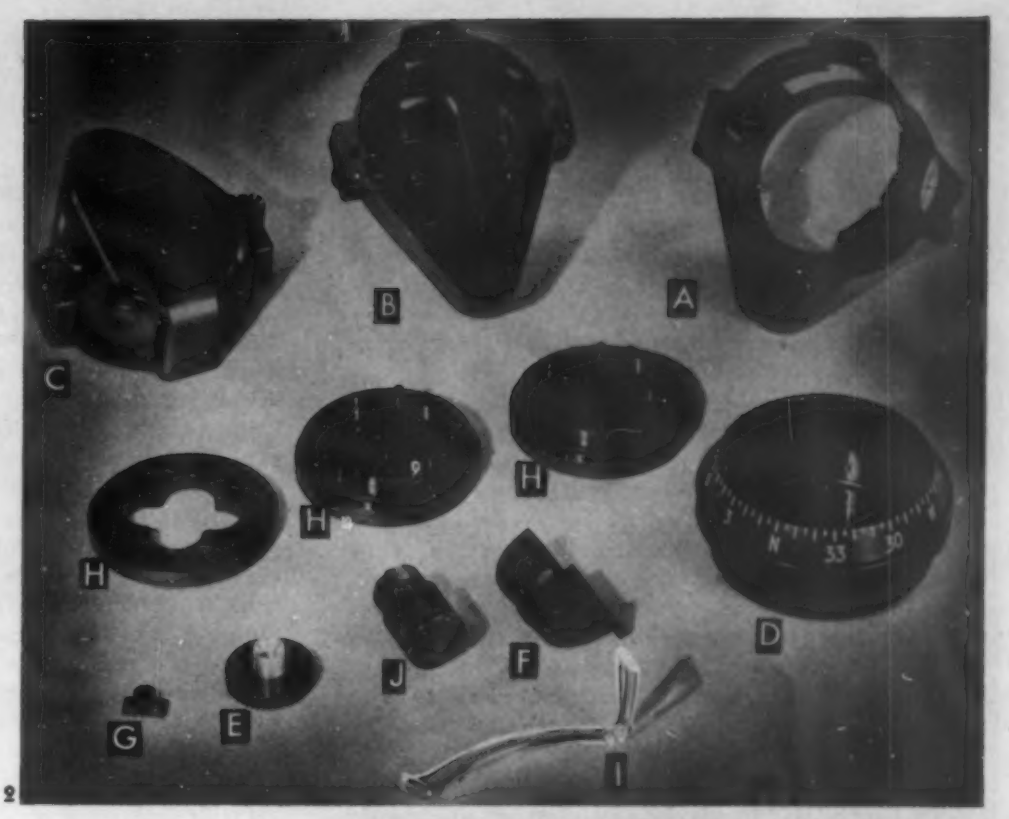
3. They have saved the Government hundreds of thousands of dollars since these newly approved instruments cost much less than units formerly in use. And this without any loss of accuracy.

The nerve center of this M-6 compass is the compass bowl assembly which consists of compass card and cap carrying a magnetic element which floats free in a transparent bowl containing non-freezing liquid. Cobalt magnets attached to the bottom of the card give it perfect balance.

Two plastics materials are used in the molding of the parts that comprise this vital section. For the compass card and cap a non-bleeding type of cellulose acetate butyrate is specified due to the fact that these two pieces must withstand constant submersion in the compass bowl fluid without suffering any distortion and without discoloring the liquid. Methyl methacrylate was selected for the molding of the bowl, baffle plate and expansion dome, partly because of the transparency of this material and partly because of its ability to withstand contact with the compass bowl fluids without ill effects.

In the assembly operation, the baffle plate is cemented into

2 and 3—The parts which comprise this compass consist of: A, case; B, case cap with light; C, case cap without light; D, course indicator; E, course indicator knob; F, heeling corrector; G, magnet holders; H, spacer plates; I, light conductor; J, protective plug; K, compass card and cap; L, compass bowl; M, baffle plate; N, expansion dome; O, quadrant post—23 plastic parts in all



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the recessed rim of the bowl. After all air has been expelled from the compass fluid, a flexible diaphragm is cemented over the transparent plate. This sealing disk forms a narrow chamber connected to the main part of the bowl through holes in the baffle plate. By virtue of this arrangement, the liquid can flow from the bowl to the upper chamber as it expands and contracts with temperature changes.

For the general housing of the M-6 compass, which consists of the case, the case cap, course indicator, course indicator knob and protective plug, cellulose acetate butyrate or high acetyl cellulose acetate was specified. These same materials are also used for such internal working parts of the component units of the compass as the heeling corrector, the magnet holders, and the spacer plates, parts which are several in number.

This heeling corrector, which is located in the cap of the compass housing, and a quadrantal post made of methyl methacrylate, which is positioned in the bottom of the unit, serve as a check on the accuracy of the compass' performance. Combined with the action of the cobalt magnets, already mentioned, they hold the instrument to a deviation of less than one degree.

Two different case caps are produced for this compass. When a methyl methacrylate light conductor is inserted inside the cap to pipe light from an electric bulb located at the rear to that section of the compass requiring illumination, a deeper cover is employed than when a lighting arrangement is considered unessential. However, even when this deeper cover is used the light connection can be done away with and a protective plug screwed into the opening designed for the entrance of the electric wiring.

In Figs. 2 and 3 the various parts that comprise this new compass are designated by the following lettering: *A*, the case; *B*, case cap with light; *C*, case cap without light; *D*, course indicator; *E*, course indicator knob; *F*, heeling corrector; *G*, magnet holders; *H*, spacer plates; *I*, light conductor; *J*, protective plug; *K*, compass card and cap; *L*, compass bowl; *M*, baffle plate; *N*, expansion dome; *O* quadrant post.

In all 17 different plastic parts, or a total of 23 pieces counting the parts that are duplicated, go into the assembly of each M-6 compass. These are produced by injection molding in fourteen multiple-cavity molds. Some of the parts are molded in combination dies and the fourteen different molds have a total combined capacity of 58 cavities.

Various methods of assembly are used in the finishing of this compass. In some parts of the instrument, different parts are made to adhere to each other through the use of a solvent of the material from which they are molded. Rivets and bosses are molded into other pieces of the compass so that they project through a second part. This assembly method is complete when the bosses are headed or riveted over by a hot-ironing operation. The third method employs conventional drilled and tapped holes for the insertion of necessary metallic screws.

The Army and Navy speci- (*Please turn to page 202*)

A case-full of health

THE postwar traveler can, if he chooses, take his ultraviolet ray health lamp right along with him and use it wherever he happens to be for, in the not too distant future, he will have available a small and compact, lightweight, portable lamp which will contrast sharply with the sometimes bulky and cumbersome apparatus now in common use in many households throughout the country.

Plans have been completed for a new and radically different ultraviolet ray lamp completely housed in a 2-piece case molded of colored urea-formaldehyde. It will be equipped with adjustable plastic arms so designed that they fold away inside the top of the case when the lamp is not in use, yet can support the cover and the reflector housed therein at any desired angle when the unit is in operation. In over-all outside dimensions the lamp is only $10^1/_8$ in. long, $5^1/_2$ in. wide and $5^1/_2$ in. high. Designed primarily as a portable lamp for individual use in traveling or in the home, the device will also be adapted for automobile use. In fact it is believed to be the first ultraviolet ray lamp adaptable to use in an automobile that has ever been made of any material.

Plans for an automobile lamp, which probably will retail for less than $50.00, are also being worked out, utilizing the car's battery. This unit will be so constructed that it can be attached to the dashboard or hung in any part of the car. It can be used to condition the car's air through ultraviolet ray sterilization while enabling the driver or passengers to enjoy the healthful effects of the rays.

The company which will introduce these new products is Sun-Kraft, Inc. Plans have been completed and molds are being made for the portable traveler's lamp; patents have been issued and other patents are still pending for the automobile lamp. Both will be additions to the regular line which consists of lamps not only for home and hospital use, but also for other specialized uses in the therapeutic and industrial fields.

Construction and design of these lamps, which differ considerably from many conventional ultraviolet ray lamps, imposed an interesting problem in the devising of a portable lamp that would be both compact and fully adjustable. In this company's lamps, a high-frequency radio oscillator circuit is used to activate the tubes. The advantage of this design, according to Frank Furedy, company president, is that it eliminates the need for fused-in metal electrodes or filaments which break down gradually—diminishing the intensity of the rays—and finally burning out entirely. Sun-Kraft tubes, which last indefinitely, are electrodeless, activated by short wave from the radio circuit.

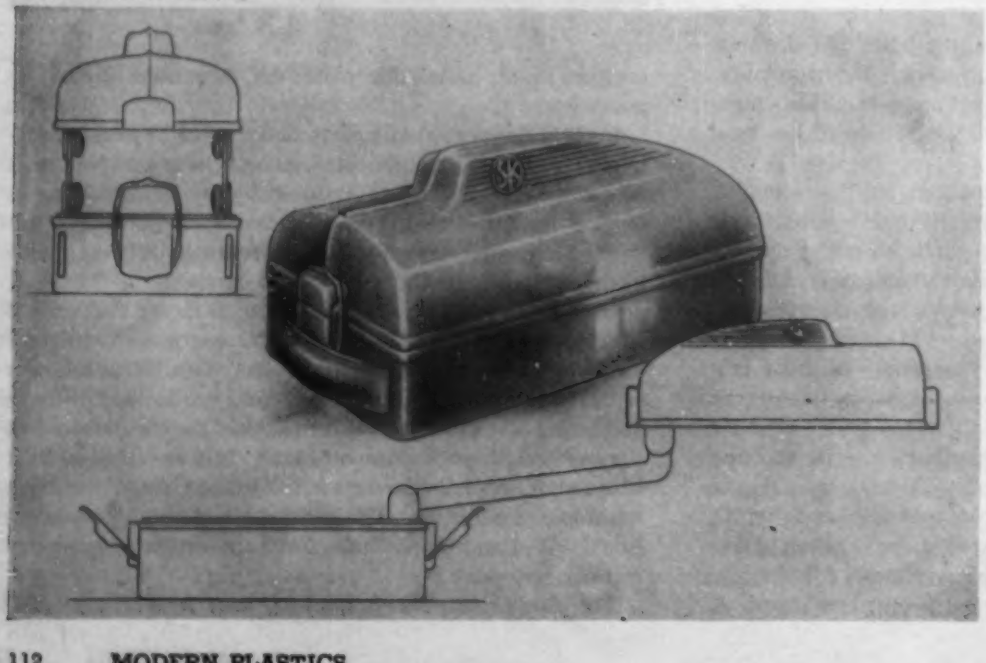
The new portable lamp has the radio circuit in the lower half of the case; the upper half contains the reflector, adjustable arms and part of the timer. When the lid is open, the reflector may be opened out and put in any desired position. The case itself is attractively embellished and finished. Straps of phenolic-impregnated canvas fabric coated with polyvinyl butyral are attached at each end to serve as handles. The color will be coffee or tan, and the reflector will have an ivory finish.

Sun-Kraft is one of the country's leading makers of ultraviolet ray apparatus. Its products are sold in well-known department stores and distributed by General Electric Supply Corp., Graybar Electric Co., Inc., Westinghouse Electric and Mfg. Co., Goodyear Tire and Rubber Co. and other leading electrical appliance distributors. Until restrictions were removed a short time ago, the entire output went for war purposes. The company has specialized in various new types of equipment including a new lamp, twenty times more powerful than the average home health lamp, which is being used by the Army in treating serious infections, gunshot and other wounds as well as to prevent post-operative infections.

Plastic applications are particularly adaptable to lamps of this type which have tubes of pure quartz and operate virtually without heat. Mr. Furedy believes plastics will find numerous uses in his field after the war when materials and manufacturing facilities are once more available.

Credits—Molded by Rathbun Molding Corp. for Sun-Kraft, Inc.

DRAWING COURTESY SUN-KRAFT, INC.



1—What to do with a full-sized health lamp when it is not in use? There will be no such problems in the postwar era when small portable units, housed in 2-piece cases molded of colored urea-formaldehyde, will be available for use in the home or in a car while traveling

Mass serving of foods

1—*The ever-present problem in hospitals and institutions of retaining the appetizing crispness or oven warmth of foods until they finally reach the patient is minimized with these covered dishes, molded of melamine, which retain the heat or coldness for as long a period of time as six hours*

FOR the most part, table and kitchen ware have followed traditional design. But in the case of the plastic products that are developed by Devine Foods, Inc., the pattern was reversed—the design and the material were picked to meet the requirements of the specialized field for which these food containers were developed.

The entire line of Devine products was specially perfected for the serving, storing and delivery of either hot or cold foods on a quantity basis. Although many of the features that make these items so acceptable to institutions, industrial plants and the Armed Forces would simplify the life of a housewife, none of the products is for resale to the public. Their use is confined, principally, to hospitals, hotels, railroads, factories and essential civilian concerns, and to certain of the Armed Services where meals must be prepared in large quantity, distributed to rather widely scattered sections, stored for varying periods of time, or again where the food is cooked by an outside concern and delivered ready for serving.

At present the company has 17 different plastics items—a coffee cup with handle, a cup without handle, a saucer, coffee cup cover, creamer, mixer cup, tumbler, cafeteria tray, compartment tray, covered dishes with capacities of one-half pint, one pint, one quart, two quarts and four quarts, a food container complete with bread compartment and two one-gallon food container dishes—a food container dish with center partition and a similar dish without this partition. With the exception of the cafeteria tray and the food container housing which are molded of a phenolic material, all the wares are of melamine. The selection of one plastic for all but two items—and these, the ones not in direct contact with food—was a result of a long period of experimentation.

In 1928, development work was begun on a food container, and soon a metal food container was being marketed all over the country. As a sales booster the company undertook a publicity campaign during which it delivered containers packed with hot meals to industrial plants throughout the Chicago area and distributed them free among the workers. The idea behind this plan was that when workmen opened the containers at noon, about four hours after delivery, and discovered how warm the food had remained,

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they would want to buy the holder to take to their wives and thereby assure themselves of hot home-cooked meals at lunch-time. The workers did buy the containers. But before long they were at the office of the company trying to sell back the carrier. They were still satisfied with the containers but they preferred them packed with hot food. They wanted to purchase a daily food service rather than a container that had to be filled at home, lugged to work and back.

After an unsuccessful attempt to interest a number of Chicago box lunch companies in such a service, Devine Foods, Inc., formed its own food division and delivered packaged meals for nearly a year. It was during this period that the difficulties were encountered which finally led to the selection of melamine for all the dishes that come in direct contact with food.

The container dishes then in use were made of metal. As the metal tarnished, the food would sour. Because of this condition the company found it necessary to clean each dish with a chemical every time it was used, a treatment that

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***2**—These covered dishes are molded with wide edges which permit stacking without each dish slipping too far inside the other, and have grooved lids to retain desired temperatures. **3**—Mixer cups with 4 molded-in lugs, and dessert dishes with wide tops, provide similar ease of stacking. They too have fitted covers. **4** and **5**—Cups, complete with grooved lids and handles designed to fit securely against the top of other cup handles, eliminate usual unmanageable piles*

finally wore down the walls until the dishes could no longer be sealed against leakage. In rapid succession other metals were tried in this application and discarded, many because of their tendency to rust and chip; stainless steel was ruled out when fabrication costs were found to be too high, and dishes of this material lost their shape under the rough handling to which they were frequently subjected.

For a while Pyrex glass dishes equipped with paper covers that were used once and discarded seemed to offer the best solution to the company's difficulties. In fact, this material still is used in some of the containers. It has two drawbacks, however: its weight and relative fragility.

Intrigued by the possibilities of plastics, the company experimented with a number of compounds. As a result of these tests it decided to mold all dishes from melamine. The principal reason for this selection was that this plastic is completely odorless and tasteless and, therefore, has no effect upon the taste of food. In addition, it is easy to keep clean since the hard smooth surface of the moldings can be quickly washed in boiling water and requires no scouring or polishing. Unlike many of the non-plastic materials that had been tried out, the melamine container and dishes were found to be highly resistant to breakage, chipping, discoloration, staining and moisture absorption and to have excellent insulating properties—retaining either heat or cold most effectively.

In plastics, the completely assembled container consists of a phenolic top and bottom casing, divider, pressure plate and two toggle clamps; two one-gallon melamine dishes; and paper covers and gasket which seal the unit against air seepage. It has an outside diameter of $10^5/_8$ in. and an over-all height of $17^5/_8$ inches. The bottom of the container is designed to hold bread, dessert, cream and sugar, forks, spoons and paper napkins. The divider serves two purposes—it forms the top of this bread compartment and the base upon which the two dishes rest. These dishes, stacked one upon the other, are rendered leak-proof by their paper covers and the pressure plate in the top casing which forces them tightly together. Frequently, one of these dishes is used to hold coffee.

Before this unit—made entirely of plastic except for the paper covers and gasket and a few metal inserts—was ready to go into production, tests were run to discover what wall thickness was best for the container. A number of experimental dies were constructed to produce walls $^1/_8$, $^1/_4$ and, $^3/_8$ in. thick. Sample containers were then molded from these dies and filled with hot food whose temperature was taken at the end of 1, 2, 3 and 4 hours. A heat curve was plotted from these readings which indicated that the optimum wall thickness was $^1/_4$ inch. This resulted in the manufacture of an individual container measuring $4^7/_8$ in. in diameter by $11^5/_8$ in. in over-all height.

It was at this point that war was declared and the company began delivering meals to the Armed Services. Experience gained during this period indicated that these containers will keep food either hot or cold from 5 to 6 hours. As a test, six containers were filled with a one-dish meal—black coffee, cream, sugar, bread and dessert—and stored in an automobile to simulate truck delivery. The containers and the Pyrex dishes, which were used in this instance, were preheated in meal packing to 154.4 and 225.0° F., respectively. The average temperatures were 83.3° F. in the packing room, 104.6° F. inside the car and 71.4° F. outside the car. At the end of each successive hour of the 6-hour test, one of the containers was opened and the temperature of the food noted. It would seem that the unit's heat efficiency is due partly to its relatively small outside surface area as compared to its food capacity and to the insulat- (*Please turn to page 198*)

6 and 7—The food container—shown assembled, right, and with lid removed, left—consists of a melamine top and bottom casing, divider, pressure plate, 2 one-gallon dishes and covers, 2 toggle clamps and a paper gasket which seals the unit against air seepage

SIGNS AND SIGN MAKING

by JAY H. TYSON*

THE technique of edge and flood lighting of plastic letters used in signs is not new. But once in a while a novel method of applying the principle merits the attention of sign fabricators. Acrylics possess several properties which make them ideal sign materials. For one thing, they readily transmit light. Again, they may be dyed almost any color with the new dyes which are appearing on the market. This last factor has added much to their value as sign materials since it makes possible day-time color harmonies.

It is usual practice in making edge-lighted or luminous plastic letters for signs to begin with a cut-out letter. This letter is then inserted or inlaid in a background of opaque plywood or other available material—especially for indoor signs. An area of illumination, usually fluorescent lights, placed behind the sign causes the translucent areas formed by the inlaid figures to glow with light.

This method of sign making has several drawbacks, including the fact that due to the warpage and lack of weather resistance in the backing material, signs built in this manner are seldom used outdoors. Letters for these signs must first be carefully cut out and finished to set dimensions, and the openings for the inserts must be accurately prepared—all of which is slow hand work. The problem of securing a close and permanent fit between the inlay and the background also presents difficulties. Any opening between the letter and the background is likely to cause a flash of direct light which would spoil the smooth effect of the lettering. There is also a possibility of unequal or uneven illumination should the lighted area behind the signs be poorly planned and, therefore, unbalanced.

To overcome the problems involved in the fabrication of in-

* House of Plastics.

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ALL PHOTOS AND DRAWINGS, COURTESY HOUSE OF PLASTICS

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1—After acrylic letters are grooved, they are fitted with supporting studs which permit the sign to be put into place on the back plate. 2—The letters are sawed from a block of 2-in. acrylic (background) and sandblasted preparatory to grooving

laid plastic letter signs, our company has adopted an interesting technique of luminous sign manufacture. The letters for the proposed sign, as illustrated in Fig. 2, are laid out on a sheet of 2-in. acrylic (seen in the background of picture behind the letters). Sawing is done on a conventional bandsaw using a buttress-thread saw blade and is followed by burr removal and sanding.

Since close tolerances are not required, the letters are placed in a router or milling machine, and a slot $^3/_4$ in. deep by $^5/_8$ in. wide is milled in the back of each letter. A $^5/_8$-in. cutter, ground to a ball point, permits a round bottom groove to be cut at a single pass. A template or jig may be used to guide the cutter. If there is not sufficient volume to merit design of a jig, these slots may be milled by hand.

The inside or U-shaped portion of the slot is then polished, while the balance of the letter is sand-blasted. Fastening studs of a force-fit expansion type are next fitted into the reverse side of the letter, as shown in the detail sketch in Fig. 4. A neon tube of any desired color is then placed in the groove. Thus, each letter has its own illumination. Several small metal strips, as pictured in Fig. 3, are used to hold the neon tubes in position, and are themselves held in place by means of small screws. A certain amount of backlighting of the panel is obtained from the exposed neon tube, but this is a relatively soft glow and contrasts effectively with the sharply illuminated letters.

The marble, enamel, glass, vitrolite or other material that forms the background for the sign is drilled to receive the wires leading to the neon tubes. Studs with loose female fittings are leaded into the holes prepared in this back plate. The studs on the back of the letters fit the nuts on the studs of the back plate, and are tightened from the front. Thus the sign may be fully serviced without removing the main panels. To renew a neon tube, only a single letter need be disconnected, as each letter is individually lighted and is mounted separately on the back plate. Figure 6 shows how a sign made by this method appears at night.

The plastic chosen for this application is thick enough to act as a complete diffusing agent for the light from the neon tube. Thus the harsh and somewhat usual effect of the conventional neon tube is given (*Please turn to page 196*)

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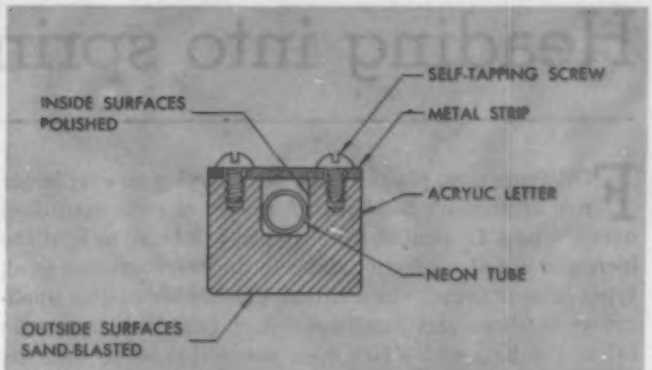

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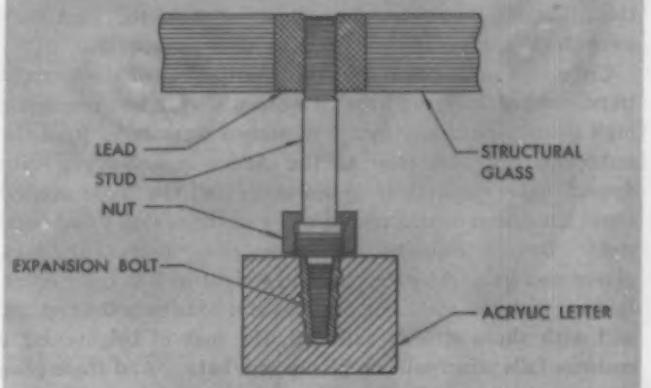

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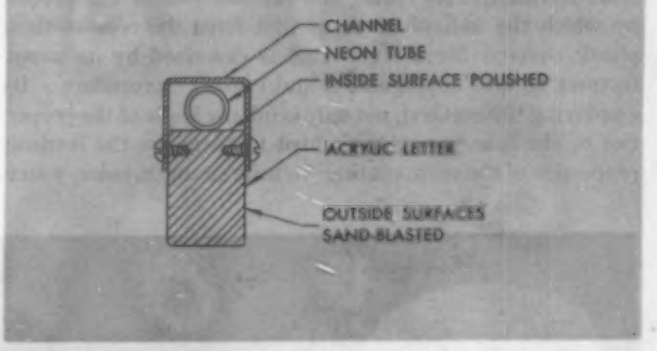

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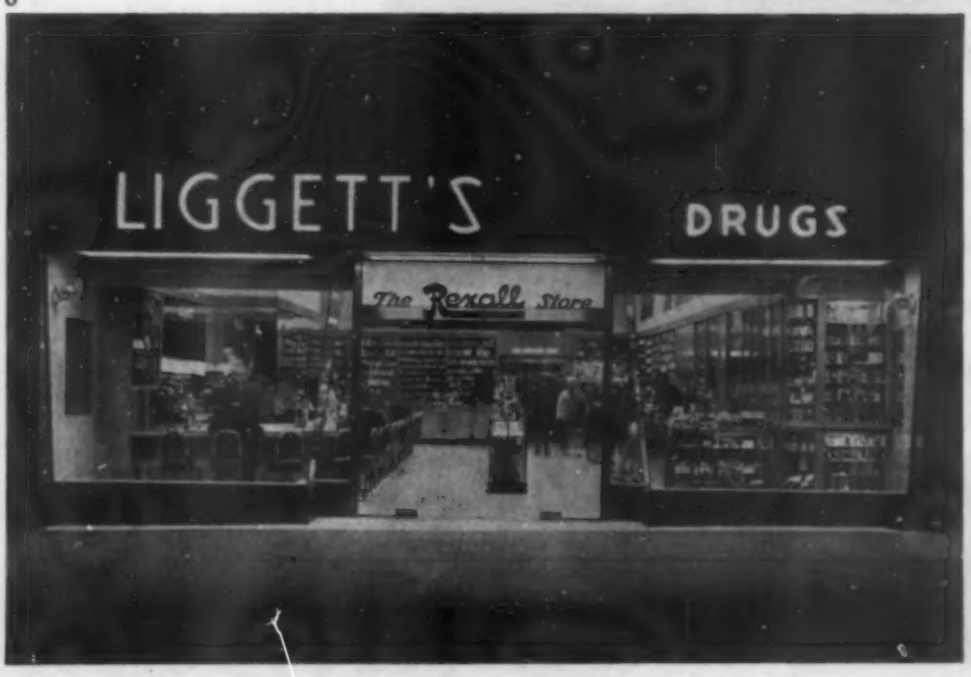

3—This section of the grooved acrylic letter shows the metal strip which holds the neon tube in place. 4—A detailed drawing of the supporting stud. 5—In the conventional method of backlighting an acrylic sign, a channel conceals the neon tube. 6—As can be seen in this night view of a sign installation, the grooved acrylic letters intensify the light. In addition, there is almost no backlighting of the panel

Heading into spring

FOR years now, plastics have been playing an ever-larger role in women's fashions. A review of style magazines over the past 12 months, for example, will bring to light the increased use of synthetic fabrics in dresses, coats and in all types of sportswear. In addition, plastics are finding application in shoes and handbags. And now they appear in bright gay hats with a lacy open weave that seems to invite the heat waves to try to do their worst.

These springtime bonnets, the creations of the Bertlyn Corp., are only now making their appearance in hat shops in the Midwest, South and Far West. But in the East they were on the shelves in time for the Easter parade.

Color and more color. In this fourth year of the war the trend toward brilliant hues in women's wear has reached a high point. Not only men but women want relief from the unbroken tan and blue of the Army and Navy. Print dresses have made their appearance, and the more neutral tones have been abandoned in many of the season's coats and suits. But it remains for accessories—shoes, handbags, gloves and hats—to carry the full weight of this color craze. In fact, with the matching of shoes and handbags the fashion, and with shoes strictly rationed, the task of brightening a costume falls principally on gloves and hats. And these plastics hats can be made in an almost unlimited range of colors.

Woven of plastic-coated yarn, these new bonnets have other advantages for spring and summer wear. The process by which the individual yarns that form the core of these plastic-covered fibers are coated is described by its manufacturer as an "impregnation and coating" procedure. By employing this method, not only is full use made of the properties of the base yarns, but added to them are the intrinsic properties of the resin coating—tensile strength, color, waterproofing, flameproofing and other characteristics which can be varied by a change in the type of resin compound used for the coating. This means that sudden showers need have no terrors for wearers of these new bonnets. There need be no frantic rush for doorways in which to huddle until the rain has passed, no newspapers held tent fashion above the head in place of the elusive umbrella, for the material from which these hats are crocheted may be rendered water repellent. Even more important, the hats can be easily sponged free of dust and dirt.

While only one type of coated yarn is now used in the hats produced by this millinery concern, the process by which the individual yarns are coated permits a variation in the size and shape of the finished fibers. This suggests the possibility of an endless variety of textures and effects in these open-work hats.

The basis for all these hats is a cap, crocheted by hand from the plastic-coated fibers, which is varied in size and depth according to the style of the bonnet contemplated. At present, a shell pattern is used, but a change can be made at any time. So that the finished hat will retain the shape planned by the designer, the caps are dipped in a special sizing prior to shaping. However, before the cap is soft and flexible enough to follow the outlines of the wooden form upon which it is shaped, it must be subjected to a steam bath.

For each size and style of hat there must be one or more special wooden forms which duplicate the outline of the hat—the brim and the crown. After the crocheted cap has been fitted snugly over this shape, the entire unit—cap and form—is placed in a drying oven where it remains until the sizing has dried and the hat has taken its final shape. It is then only necessary to insert the head band—and the hat is complete.

Credits—Material: Plexon. Hats by Bertlyn Corp.

1—Bright and cool are these new springtime hats crocheted from plastic-coated yarn. The samples pictured here represent but a few of the models that are beginning to make their appearance in hat shops throughout the country

PHOTO, HAROLD M. LAMBERT

1—These blue-green polystyrene talcum bottles have proved popular with men because of their sturdiness and lightness. The multi-color decoration is silk screened

Packaged for men

THE "Sportsman" line of men's toiletries marketed by John Hudson Moore, Inc., is adroitly keyed to what might be called the carriage trade in the men's field. The package styling is rich but restrained, its central theme a multi-color silk-screen reproduction of such sporting items as a game bird or a horse's head. From every aspect—texture, form, decoration, color—the containers are most carefully designed to overcome the all too common masculine aversion to cosmetics.

Until recently, when the company adopted a molded polystyrene container, the talcum was packed in stock-mold square glass bottles. To achieve the effect desired by the company, the bottles had first to be spray-coated on the outside with an opaque blue-green enamel. This required an intermediate shipping step between the glass plant and the silk-screen printers where the bottles had to be handled a number of times as the various colors of the silk-screen decoration were applied in separate operations.

It will be seen that in this multiplicity of handlings the chances of damage or actual breakage of the containers were far greater than in the case of the ordinary glass bottle, which is simply filled, labeled and sent on its way. However, the principal mechanical difficulty with the glass bottle was in filling. The bottle had an opening of approximately $^{15}/_{32}$ of an inch, and filling with a fluffy dry product such as talcum was a tedious and time-consuming operation. An additional operation was the insertion of a shaker cork which provided a single center opening for dispensing the talc.

A metal can would, of course, overcome most of these difficulties, but even if metal were available, it would not be acceptable to the company for the reason that it is so commonly used for talcums of all grades and types. The manufacturer insists on the unusual in packaging materials, to lift his products out of the ordinary. He has always, for instance, used threaded wooden closures, rather than plastics, for all his men's products.

Casting about for an acceptable substitute for the glass talcum bottle, the executives of this toiletries firm considered metal, then wood for the bottle itself. It was felt that such a wood bottle might lend itself to filling from the bottom, with the bottom to be glued in afterward. It was found, however, that such a highly special item would be difficult of supply and might be prohibitive in cost.

Finally, plastics suggested themselves, but at the time plastic containers in bottle form were practically unheard of in the toilet goods industry. Blown plastic bottles were a recent development, but the entire available supply was earmarked for military use. The company put the problem

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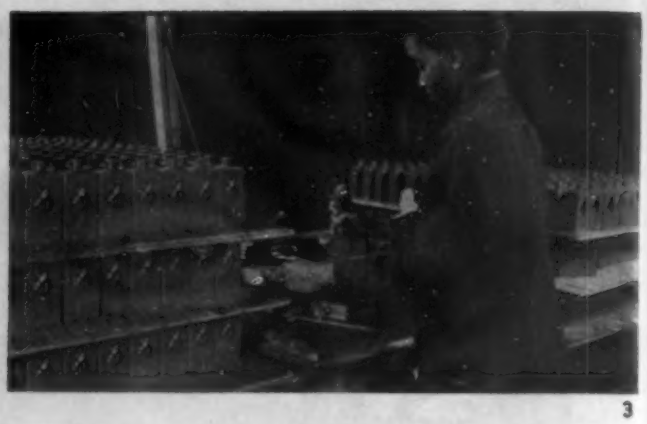

3

2—Special enamel inks for plastic are hand-applied through a silk screen with a hard rubber squeegee. 3—The polystyrene bottles go through this process from 8 to 11 times, depending on the number of colors

up to its plastic molders who were given a sample of the glass bottle and asked to duplicate it—in a plastic molding that would be attractive, convenient and economical. It was considered essential to keep the same shape, design and color, and the same wooden closure as before.

The new talc bottle now on the market, is injection molded of polystyrene in multiple-cavity dies in a high-speed operation. The bottle is complete as it comes from the mold, except for the separate bottom piece and, of course, the wooden top closure. The recessed bottom piece is molded and shipped separately. The top of the container is complete as the part comes from the mold threaded for the closure and closed except for the five small perforations through which the talc is dispensed.

The obvious advantage of this 2-piece construction is that the bottle may be filled from the bottom, through the full section. This has had the effect of speeding up tremendously the filling operations at the John Hudson Moore plant. The threaded top closure is first applied to the empty bottle, and the bottle up-ended and filled with the required amount of talcum in a single shot. The snug-fitting bottom piece is then coated on the edges with ethylene dichloride and slipped into place, resting on a shoulder of the molding. This cemented bottom is not only completely siftproof but, according to the molder, liquid-tight as well, suggesting that the same type of bottle could be used for liquids for which the molded-in sprinkler top would be advantageous.

Although to the eye the plastic bottle is an almost exact reproduction of the glass, it has, on close examination, some distinct advantages in sales appeal. Not the least of these is the soft, smooth "feel" of the plastic when the container is handled. Light weight and the impression of indestructibility that plastic conveys are also in sharp contrast, on the credit side, with the heavy and fragile glass bottle. The delicate mold mark which runs across the top and down the sides of the plastic bottle gives a pleasing break-up to an otherwise plain surface.

The blue-green color of the plastic bottle is inherent in the material—it won't scratch or chip off as will the enamel from the glass. Furthermore, the color surface is as smooth as a mirror, in contrast to the enamel which has a slightly dappled look. Finally, the silk-screen decoration is less easily damaged on the polystyrene surface. New inks specially developed for silk-screening on plastic have a tendency to etch in and take a firm grip, while on glass the decoration is no better than the enamel on which it rests.

Additional practical advantages became apparent as soon as the bottles went into regular production. When made of glass, the bottles had to be shipped from the glass plant to the spray coater to the silk-screen printer and finally to the Moore Company, being loaded and unloaded and handled several times at each stopping point. The plastic bottles go directly from the molder to the silk-screen printer and thence to the Moore plant. Production is speeded up and opportunities for damage minimized.

And shipping costs are reduced all along the line. The plastic bottle when filled with 4 oz. of talcum weighs only 6 oz., as compared with $11\frac{1}{2}$ oz. for the glass container. Shipping containers cost less and weigh less, since boxboard and partitions of considerably lighter weight are adequate for the plastic.

Polystyrene was selected as the proper plastic for this job because of its fine chemical resistance, good molding characteristics and low cost. Prior to its adoption it was given laboratory tests which showed that it would impart no odor to the delicately scented talcum. The molder states that the plastic bottles can be produced faster than glass and with less employment of manpower, and that they have greater uniformity of dimension.

While polystyrene has less impact strength than acetate, it is quite adequate for the requirements of this job, and it is used in relatively thin wall sections—again helping to keep down weight and cost. Its color stability is excellent, and it is capable of taking almost any color in the spectrum. It would be possible to mold the same bottle in transparent polystyrene, but although this may be suitable for some products of this type, it was not considered to be desirable as a container for talcum powder.

The "Sportsman" talc is marketed, as it has been in the past, in two sizes—4 oz. and $2\frac{1}{2}$ oz. net. The two plastic bottles are identical except for size. There is a 4-cavity injection mold for each size bottle and an 8-cavity injection mold for the base. The only finishing operation required of the molder, after the bottle has been taken from the mold, is a slight gate and flash removal.

In this case a flat, plain surface was desired. It is perfectly possible, however, to mold any embossed or debossed design right into the bottle, and there are many other decorative possibilities.

The new plastic bottle is as popular with the silk-screen printer as it is with the Moore Company and its customers. Physically, the plastic bottles are much easier and less hazardous to handle. The hard oil enamels used extensively by silk-screen processors for labeling and decorating glass con-

tainers were found to lend themselves equally well to the decoration of polystyrene. Slow-drying enamels are chosen as a rule. A longer drying period permits the solvents in the enamel to act upon the surface of the polystyrene in a way that insures a permanent bond.

While some experimental and short runs had demonstrated the fact that a silk-screen application of enamel to polystyrene was eminently satisfactory from the point of view of durability, the "Sportsman" talc containers provided the first real opportunity to test the process in large commercial runs. There was no difficulty whatever encountered in this application.

The "Sportsman" line offers the customer a choice of three decorative designs—the mallard duck, the pheasant and the horse's head. All three designs are applied to both the large and small sizes of talc containers, and they are shipped in assortment. Depending upon the design, all containers receive from 8 to 11 imprints of color, and the colors have to be in register to a very fine tolerance. The uniformity of the polystyrene bottles has been found of considerable help in maintaining accuracy of register in production runs.

The enamel decoration on the finished package has a slightly glossy appearance and a slightly raised surface, giving an embossed effect. It is said to stay perfectly clean and bright through all the hard knocks of ordinary shipment and use, and it adheres to the surface quite as permanently as though it had been molded there.

One note of caution is necessary for those packagers who would take a leaf from this company's book. Under the present wartime restrictions, polystyrene is by no means in plentiful supply, and it is not generally being allocated for such non-essential items as cosmetics. The packager who adopts a polystyrene bottle at this stage must be prepared to meet interruptions of supply and must be ready to fill in with a substitute.

Credits—Material: Lustron. Bottles injection molded by Prolon Plastics, Div., of Pro-phy-lac-tic Brush Co. Silk-screen printing by Creative Printmakers Group. Wood closures by Gibson-Jones Co., Inc. Work done for John Hudson Moore, Inc.

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4—The bottoms of these polystyrene bottles are molded separately from the body. This is a distinct advantage during the filling operation since the talc can be poured through this bottom opening more rapidly than through a small top. 5—Compared to the glass bottle, the recessed construction of the bottom of the plastic container gives a firm, level base. 6—The sprinkler top on the polystyrene bottle is threaded and perforated in a single molding operation. The glass container (left) requires a cork, inserted after filling. 7—The plastic bottles come in two sizes, 4 and 2½ ounces

PLASTICS

AMONG THE FIRST THINGS THAT A SOLdier reaches for when he enjoys a brief respite from the business of making war are sleep, a bath, food—and above all, a shave. Although his equipment may already be packed to the limit with field necessities, he usually manages to squeeze in his personal shaving kit. Realizing this fact, the Army has taken care to provide him with complete shaving equipment which is fully protected against the ravages of destructive elements.

The protection for these razor sets is provided by cases of cellulose acetate butyrate, weighing about $3^1/_2$ ounces. The covers and bottoms of these cases are molded separately in 10-cavity dies, a complete shot of covers weighing approximately twenty ounces and that of 10 bottoms weighing 25 ounces—probably the heaviest shot obtainable in a box of this type produced in a multi-cavity mold.

Credits—Material: Tenite II. Molded by Mack Molding Co., Detroit Macoid Corp. and Udylite Corp. for American Safety Razor Corp. for U. S. Army

SAFETY ENGINEERS, IN ANALYZING THE factors which militate against highest efficiency in war plants, have found that the worker is his own greatest obstacle to his complete safety. The many measures provided for his protection are often put aside because he finds them cumbersome or a hindrance to his complete freedom of movement. This is particularly true in the case of safety goggles. Having found some of the original models an annoyance, he continues to put the glasses aside, so that goggles' manufacturers have to keep on their toes improving and perfecting their wares in order to produce models which will have both eye appeal and practicality.

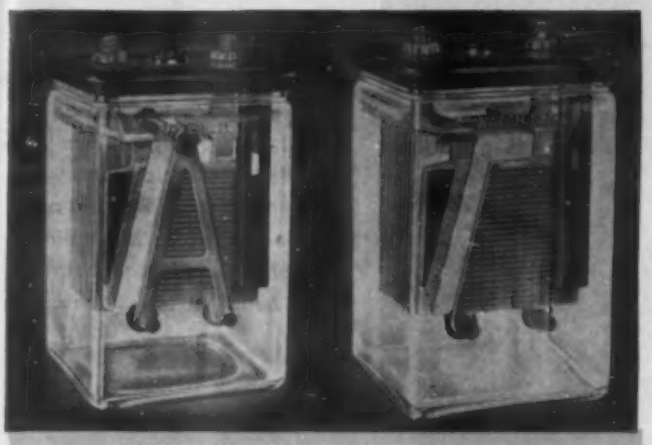
Typical of the improved models are these lightweight goggles molded of cellulose acetate. They are shaped with a flowing contour which offers 132 degrees of unobstructed vision by having the lenses set at an angle with each other, and set on a downward slope to eliminate glare and reflections. To minimize fogging, cross ventilation is provided by openings on either side, which are guarded by a polyvinyl chloride acetate strap.

The lenses, either clear or tinted, are made of cellulose acetate or acrylic. They snap into position, are quickly interchangeable and have a 45-degree bevel on the inner edge so as to set snugly against the bevel in the lens rim. Lenses are supplied in thicknesses ranging from 40 to 125 thousandths, depending on the application. A molded-in taper of 25 degrees in the rim over the lens holds it against a 45-degree taper in the inner surface of the lens opening.

The goggle is light and is found to be slightly flexible so as to allow for greater strength. A slight rim around the lens prevents it from getting scratched, no matter in what position the goggle is laid down.

Credits—Materials: Tenite and Vinylite. Molded by Plastic Engineering, Inc., for Victory Goggle Co.

PRODUCTS*



ONE OF THE PRINCIPAL OBJECTIONS TO farm life has always been the fact that because of special requirements of soil and climate, many farms must of necessity be situated in regions of the country remote from the general benefits of public utilities. This factor has been minimized, however, in recent years with the development of numerous individual units of equipment such as gas tanks, electric pumps, generators and the like.

For example, low-cost Farmlight batteries of various types can be obtained which provide dependable light and power for farms which are not connected directly to power lines. In selecting the type suitable for the needs of the individual farmer, the dealer must first make a survey of the customer's special requirements.

One battery, carrying a five-year guarantee, is of felted glass fiber mat construction. The mats are placed on each side of every positive plate in order to retain the power-producing active positive material throughout the life of the battery. Another battery, known as the wrap-around type, carries a ten-year guarantee. In this battery an "A" shaped frame holds the plates together, providing resistance to both buckling and warping. This type of construction gives great strength to the entire element and provides a method of combatting plate distortion often present in batteries of ordinary construction.

Wrap-around felted glass fiber mats are individually wrapped entirely around every positive plate. They support the exposed surfaces of the active material of each positive grid. The mats are made of finely spun glass fibers held together with a binding agent. Pores of the mats are minute indirect openings, so small they permit passage of only small, spent particles of active material. Because active material is locked in the plates, the life of the battery is thus greatly extended.

Credits—Material: Felted Fiberglas. Batteries manufactured for Goodyear Tire and Rubber Co. by National Battery Co.

* Reg. U.S. Pat. Office.

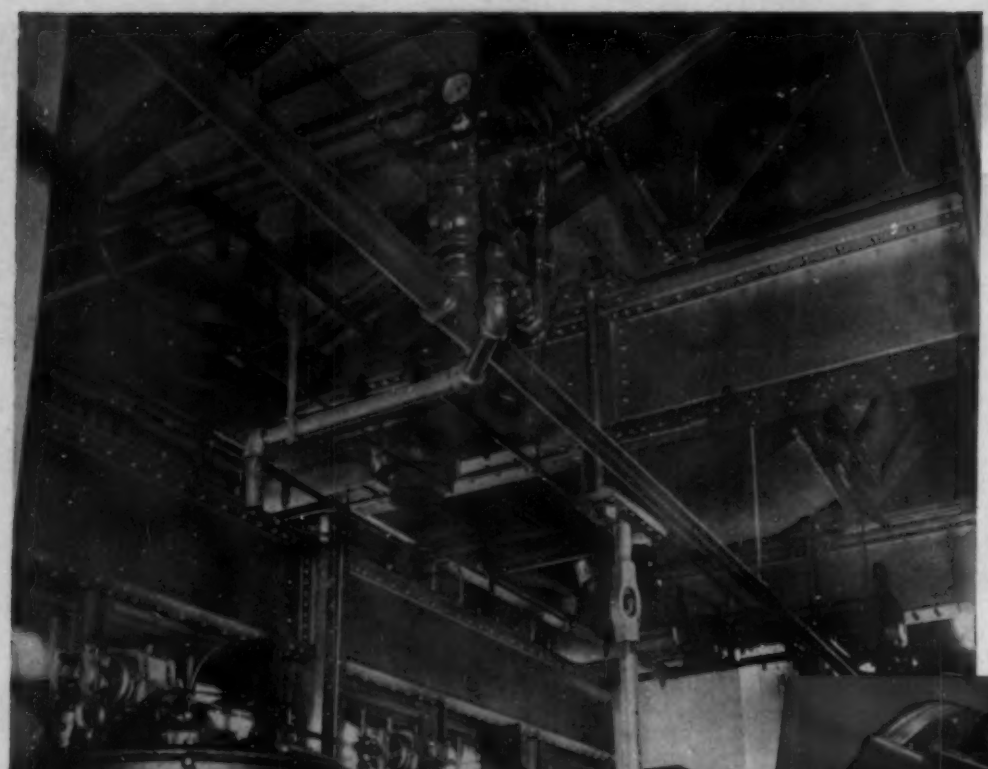
THE AVERAGE WORKER DOES NOT REALize how dependent he is on the lowly pencil until he finds it too short to be usable or minus its ever-handy eraser. With the plentiful prewar supply of these props no serious source of annoyance existed, but even these items are now limited or not so reliable.

Utilizing plastics to advantage, a streamlined wood-encased pencil—awaiting Government release of material for its manufacture—has recently been developed which promises full use of the shortened pencil far beyond its usual life. The design also contemplates an eraser designed to outlast it. This new type of eraser is securely held to the pencil without ferrules, making its full length usable.

These Fortune pencils have a molded insert of cellulose acetate butyrate which fits into the end of the pencil and has two point extensions on its end which press into the wood to hold permanently. The end of the insert protruding from the pencil is coarsely threaded. The Duraform eraser fits securely over these threads and is thus held and locked firmly.

The feature of these pencils is a one-piece Longerite pencil lengthener molded of cellulose acetate butyrate. The shaft, tipped to match the threads of the pencil insert, screws over the threaded insert of the pencil stub. The body of the shaft is thicker at the enlarged point than the body of the pencil so that the plastic dowel does not come into contact with the sharpener. The end of the lengthener has a threaded insert, similar to that on the pencil.

Credits—Material: Tenite II. Manufactured by Triple "E" Products Co.



PHOTO, COURTESY "AUTOMATIC" SPRINKLER CORP. OF AMERICA

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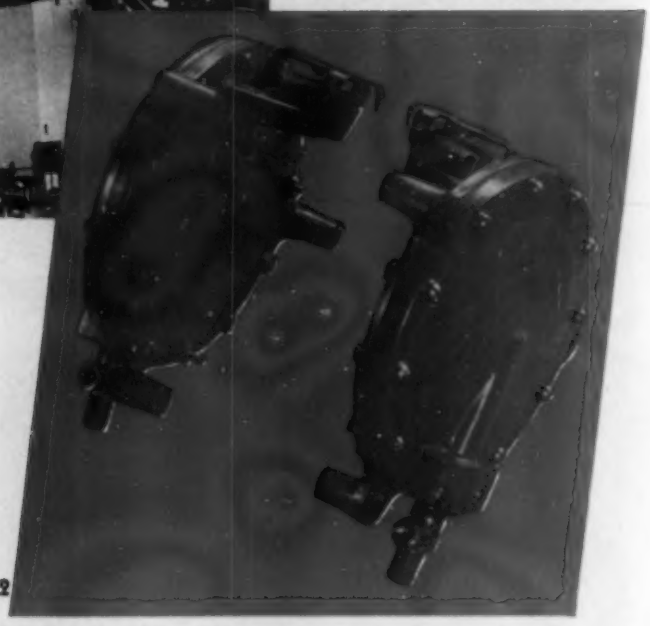

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1—Automatic protection against fire hazards is provided by these rate-of-rise heat detectors, shown installed in a factory unit. 2—The two sections of the plastic housing for the metallic diaphragm which constitutes the heart of the mechanism

Rate-of-rise fire protection equipment

EVERY home, every business establishment, every factory has some method of fire prevention—conscious or unconscious. Yet fires continue to break out. Seemingly, *fire prevention* is not enough. *Fire protection* systems are essential, systems that are quick, dependable and completely automatic, entirely free of the human element that too often forgets or ignores fire prevention rules.

The "Automatic" Sprinkler Corporation of America has recently developed rate-of-rise fire alarm, fire control and fire extinguishing systems that depend for much of their success on the unfailing operation of diaphragm cases molded of laminated cotton fiber and phenolic resin. All of these systems are actuated by the rate at which the temperature increases rather than by the height to which it goes. The theory behind this method is that an abnormal rate of rise indicates the existence of an abnormal condition. The fire alarm, fire control or fire extinguishing systems are designed to go off even though the actual temperature may be too low to affect fire fighting equipment that is designed to function only when the alloy in a fusible link heats up and melts at a predetermined temperature (which is usually 165° F.).

Essentially, each system consists of one or more heat-actuated devices, or heat detectors, fastened at intervals to the ceiling and connected to a diaphragm case in a release mechanism by means of air-tight tubing. Heat from a fire causes the small amount of air that is trapped in the heat-actuated device nearest the flames to expand. In turn, this pressure is conveyed through the air tubing to the release mechanism where it moves a sensitive metallic diaphragm which starts the fire protection apparatus working. For example, in the fire-door release, the movement of the diaphragm causes a weight to drop—an action that closes the fire door. This same motion actuates alarms in the fire alarm systems and releases the water in the fire-fog and sprinkler systems.

The diaphragm case and the metallic diaphragm are the heart of the mechanism upon which the operation of these systems depend. Consequently, it is of utmost importance that the two molded parts that comprise the case be precise in their measurements. Otherwise, the sensitive diaphragm which is held in place between the halves of the housing may be thrown out of line so the actuating air impulse will not blow against it with the necessary force. (*Please turn to page 200*)

Polyamide resins

by A. G. HOVEY*

RESINOUS polyamide materials were developed industrially about ten years ago. They are, in general, reaction products of polybasic acids and polyfunctional amines carried out in such a way, and under such conditions, that a predominance of linear polymers are formed. There may be a certain number of cross-linkages due to some excess of functionality in one or more of the reacting ingredients, but conditions are generally so controlled that very little else but the linear polymers are formed. Although the polyamides, such as the polyhexamethylene diamide of adipic acid, have important industrial applications in the popular artificial fibers and as transparent sheet material of low moisture vapor transfer, they have not as yet found any considerable use in the coatings field.

Within the past year a new type of polyamide resin has been developed which involves the reaction of polyamines with new derivatives of drying-oil fatty acids. These resins exhibit considerable promise for coating compositions. The pioneering work was carried on at the Northern Regional Research Laboratory of the U. S. Department of Agriculture. Dr. John C. Cowan[1] early this year announced the first product of this series under the name "Norelac." This product is produced by reaction of ethylenediamine with the dimerized and trimerized linoleic and linolenic acids of soybean oil. The probability of many other modifications was suggested; and several methods of manufacture and some industrial applications were brought forward.

Perhaps the most important difference between these two types of polyamide resins is in the starting raw materials. Relatively simple and pure materials which can be classed as definite organic compounds have been used to make the clear, transparent materials called nylon; for example:

$$H_2N(CH_2)_6NH_2 + HOC(CH_2)_4COH$$

(Hexamethylene Diamine) (Adipic Acid)

$$\longrightarrow \left[-C(CH_2)_4-C-N(CH_2)_6N- \right]_n$$

(Nylon)

An improvement, whereby the carboxyl groups are protected in prior processing, consists in reacting the methyl esters of the dibasic acid by direct ammonolysis with the diamine. Nylon is a generic term for synthetic fiber-producing polymeric amides having a protein-like structure and characterized by extreme toughness, flexibility and strength.

The group of polyamide resins to be discussed in this article are those which are the reaction products of polyamines with groups of polybasic acids, rather than with any single and definite polybasic acid. Most of these polybasic acids originate from processing natural vegetable oils resulting, for example, in mixtures of dimerized and trimerized linoleic and linolenic acids. As one looks upon polyamines and polyfunctional acids as the principal reacting ingredients, such resins are still in the class of unmodified polyamide resins. Development of modified polyamide resins is still in the future.

General characteristics

Polyamide resins formed by the reaction of ethylenediamine with the dimerized and trimerized linoleic and linolenic acids have, on first sight, a similarity to alkyd resins, but they differ from alkyds in many important respects. One of the base resins[2] is a dark, amber-colored substance of molecular weight 3000 to 5000. It is soluble at room temperature principally in alcohols, such as *n*-butyl, isopropyl and tertiary amyl alcohols, and in cyclohexanol. It is also soluble in mixtures of equal parts of these alcohols with either the aromatic or the aliphatic diluents. However, it is insoluble at 100° C. in ethylene glycol, glycerol, diethylene glycol, ethanolamine, vegetable oils and lubricating oils. It is also insoluble in acetone, diethyl ether and in petroleum naphthas even at boiling temperatures, and only moderately soluble in such strong aromatic solvents as benzene or toluene when hot. Ethyl and methyl alcohols are not true solvents; they merely swell the material.

It will at once be seen that the solubilities alone stamp these polyamide resins as unique. They have their true solvents, but the band of solvency is very narrow. While this is a greater challenge to formulative ingenuity, it means that once the material is formed into a film or coating, the resistance to solvent hazards is quite high. This property coupled with resistance to mild acids and mild alkalis makes this resin of great potential usefulness. On the one hand it is resistant to hydrocarbons, oils, greases and gasoline, while on the other it is extremely resistant to attack from aqueous systems. Another advantage lies in the fact that the resin is not easily ignited.

Polyamide resins similar to the example cited are amber-colored, tough resins that possess excellent adhesion at elevated temperatures just below the actual molten condition, but are not tacky at room temperature. In the molten state, these resins possess a heat stability against gelation tendencies as compared to alkyds which in general rapidly approach a heat-irreversible gel under the same conditions. The inertness of polyamide resins to alkalis, mild acids, water and solvents is of a new order compared to the alkyds we know today.

These resins possess sufficient cohesive strength so that when used with paper, metal foils and cellophane for heat sealing and laminating, the bond is generally stronger than the materials which are being sealed. Modification with other film-forming materials, tackifiers and plasticizers should open up new fields for use on wood, tin and other materials. Early results of exterior exposure tests are reported as good.

Toxicity studies

Polyamide resins have been found to be non-toxic to white rats when fed at a 5 percent level. Throughout a 21-day test period, the animals exhibited no apparent disorders, grew at

* In charge of new chemical development section, General Mills Research Laboratory.

[1] Oil and Soap *21* 101–7 (April 1944).

[2] General Mills Polyamide Resin Series BD, Hot Melt Uncompounded No. 4, is used as the illustration.

an average rate, and appeared normal and healthy. No outward disorders were apparent at any time and autopsies did not reveal any abnormalities.

Over the past year, the workers in the laboratory and in the pilot plant producing polyamide resins have shown no dermatitis or other disorders which were traceable to polyamide resins or to the raw materials and intermediates. From these preliminary results, the toxicity angle on polyamide resins appears very favorable.

Moisture-vapor transfer data

Polyamide resin, hot-melt compounded ED-95, coated on both sides of 25-lb. cereal glassine paper at 6 to 12 lb. per 24 by 36 in., 500-sheet ream basis, has a flat moisture-vapor permeability according to TAPPI standard test T448 M-41 of 0.85 to 1.2 g./m.²/24 hours. Standard fold permeability on the above sheets is approximately 15 g./m.²/24 hours.

Flat permeability of 24-lb. cereal glassine coated with paraffin wax is approximately 0.2 g./m.²/24 hours, and fold permeability is approximately 18 to 20 g./m.²/24 hours. Flat permeabilities of 25-lb. cereal glassine coated both sides with the Series ED uncompounded polyamide resins, 6 to 12 lb. per 24 by 36 in., 500-sheet ream basis, is of the order of 100 g./m.²/24 hours.

Hot-melt coatings and heat-seal applications

The uses which have developed the fastest for these polyamide resins are in the hot-melt coatings and heat-seal applications. They have proved very attractive for these purposes because it is possible to heat seal waxed paper. They heat seal at a temperature lower than is commonly used for this purpose and yet do not "block" at room temperature. The lower temperature for sealing permits manipulation with less danger of weakening the paper or other materials which are sensitive to high temperatures. Higher temperatures are permitted for heat sealing if the speed of the sealing machine is stepped up so that the full temperature of the sealing machine does not take effect on the sealing material. Temperatures above 135° C. are not recommended; if the polyamide resin is allowed to become too hot it spreads out on the paper as an oily film, possessing no appreciable adhesion until the material has cooled below 100° C. In other words, the hot-melt coating can be overheated to such an extent that the viscosity becomes so low that it soaks into the paper, and while it is overheated it possesses no adhesion.

These polyamide resins, when used at the correct temperatures and sealing speeds, possess marked advantages over other heat-sealing materials. The narrow band of solubility together with the resistance to alkalis and to ignition make them resistant to a wide variety of hazards. The favorable preliminary toxicity reports give further encouragement for paper-coating applications. The higher speed of coating paper by hot-melt application as compared to coating paper by use of solvent is desirable for overcoming war production bottlenecks.

Lacquers

These polyamide resins are compatible in all proportions with SS ½-sec. nitrocellulose and compatible with RS ½-sec. nitrocellulose over a wide range of compositions excepting ranges where the proportion of resin to nitrocellulose is substantially in excess of 4–1. As in the case of the hot-melt coatings, the resistance of the polyamide resins to mild acids, strong alkalis and water on the one extreme and to gasoline, oils, greases and hydrocarbon solvents on the other, together with low susceptibility to ignition, constitutes a unique and desirable combination of inertness.

Wood sealers

When considering these polyamide resins for wood sealing they should not be compared with shellac and with other materials now being used for this purpose, because even with the recent price reduction, they are still too high priced for such a direct comparison on cost alone. They should not, therefore, be considered for a "shellac substitute" but from the possibility of a "shellac improvement." By the use of polyamide resins in admixture with alcohol-soluble resins which by themselves are too brittle, it should be possible to make a coating—elastic enough to be free from checking and cracking—with which to seal off knots of pine, Douglas fir and other high resin content woods.

In making spirit varnishes and sealers, it should be noted that the polyamide resins are not directly soluble in either wood or grain alcohols, but isopropyl and normal butyl alcohols are primary solvents. Isopropyl alcohol is a relatively cheap and available alcohol which has been used as a substitute for denatured alcohol in many industrial applications during the past three years. Aliphatic and aromatic hydrocarbons may be used to advantage in small proportions with isopropyl and higher alcohols. Investigation of isopropyl alcohol-solvent combinations is recommended for exploration of the usefulness of polyamide resins for toughening brittle spirit varnishes and wood sealers. It is too early to tell how these improved wood sealers should be made but there appear to be at least three main possibilities of composition: 1) A large proportion of shellac and a minor proportion of polyamide resin using isopropyl alcohol as the primary solvent; 2) lacquers using polyamide resins; and 3) an admixture of phenolic resins and polyamide resins.

In wood sealers fortified by polyamide resins to reduce brittleness, it must be expected that the improved sealers will not be as easily sanded as is the case when the brittle resins are used alone.

War uses developed in 1944

In the relatively short time that these polyamide resins have been available, there have been developed a number of specialty war uses particularly on packaging and protecting articles for overseas shipment. Most of these cannot be discussed for obvious reasons.

The shipping of expensive highly machined tools has no doubt taught shippers and manufacturers valuable lessons for postwar. As pointed out by the Army Service Forces Manual: "The American war equipment must face many hazards in its transportation. When these hazards have been overcome and the equipment reaches the troops who need it, a victory of supply has been won, *if the equipment is in perfect condition*. A victory becomes a defeat when the part or assembly is found to be worthless from corrosion or moisture damage." Damage from mechanical injury is also just as costly and demoralizing.

In polyamide resins, the packaging engineer has a useful ally not only for the more conventional types of packaging by coated papers, heat-seal envelopes, pressure-sensitive adhesive cloth wrappings, etc., but also for the direct protection right on the surface of valuable accurately machined metal parts. Polyamide resins are one of the most promising ingredients for the steadily improved types of hot-dip stripping compounds which provide protection of Army and Navy equipment and spare parts against (*Please turn to page 192*)

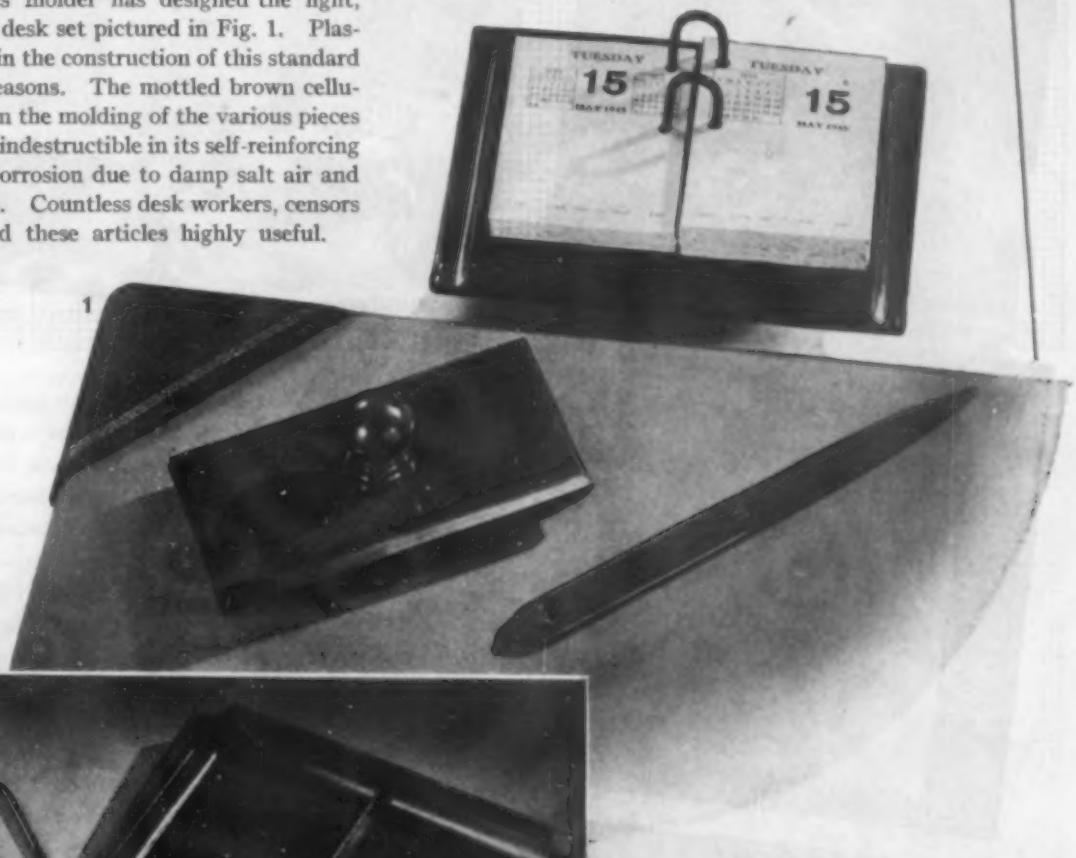
A letter home

ONE hears a great deal about the need for writing to the boys in the service of our country. We can now give you a glimpse of the other side of the picture; of the letters that are written to the folks back home, the thousands of reports that flow from every military headquarter and Government office.

All over the world countless offices are being set up to expedite our war effort and to give our service men a center where they can scribble off messages for home. To help meet the need for office equipment with which to furnish these bureaus, one plastics molder has designed the light, easily packed and shipped desk set pictured in Fig. 1. Plastics play an exclusive part in the construction of this standard desk set for a variety of reasons. The mottled brown cellulose acetate material used in the molding of the various pieces is light in weight, virtually indestructible in its self-reinforcing molded form, and resists corrosion due to damp salt air and adverse climatic conditions. Countless desk workers, censors and shipboard officers find these articles highly useful.

The letter opener is a homey article. One would scarcely think of it as a war item, and yet it is. A neatly opened letter is a necessity, for in the case of many orders (or a treasured letter from home) the envelope is retained as a protective covering for the contents. Injection molded of cellulose acetate, the paper knives are often stamped in gold with identifying lettering of the department supplying the matériel.

The loose-leaf calendar pad and memo sheet holder is designed to hold standard No. 19 Columbian art works filler. The piece is injection molded of (*Please turn to page 194*)



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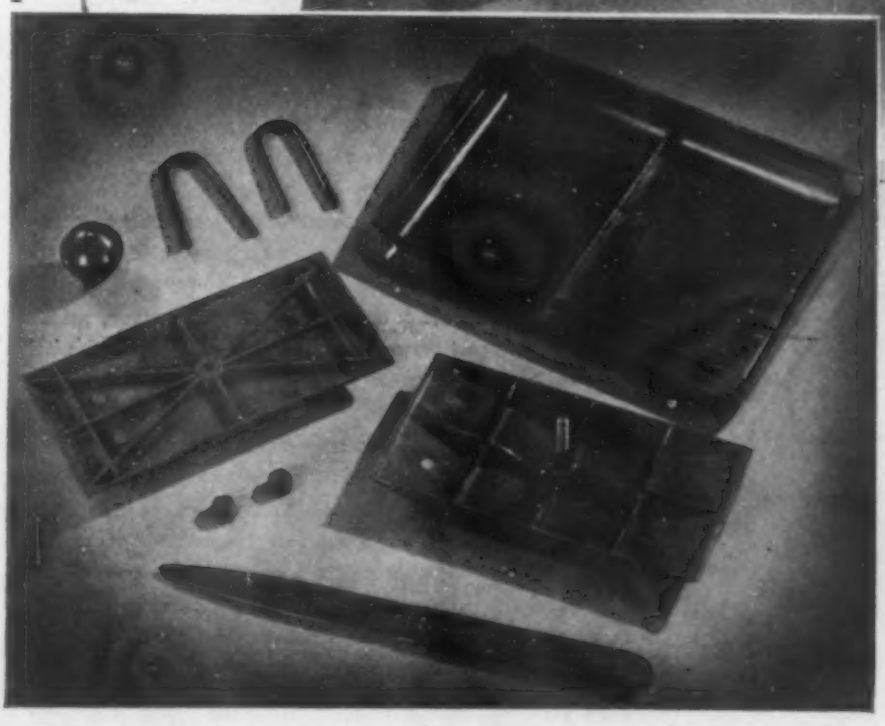
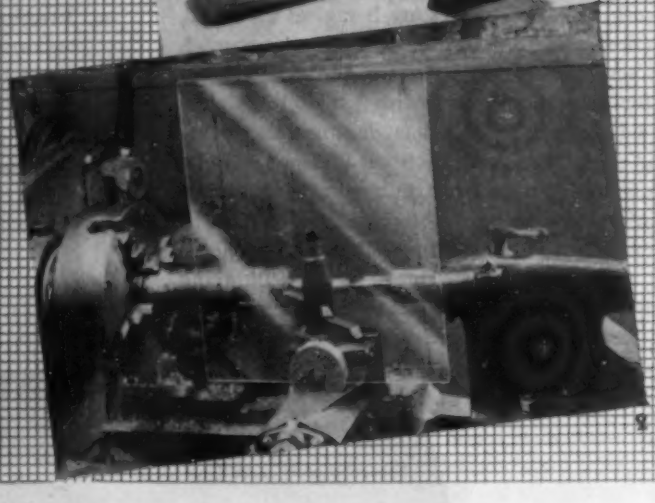
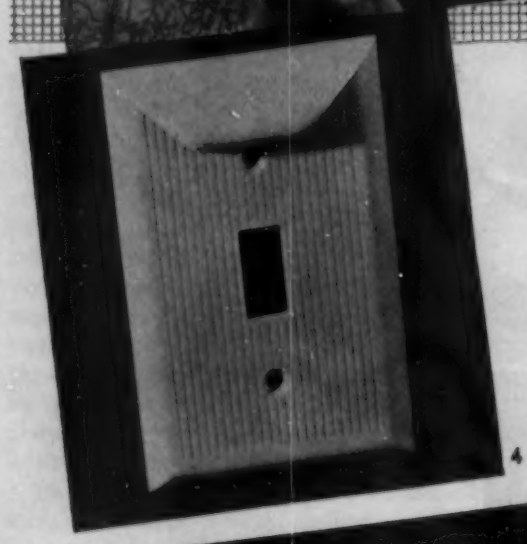


2

1—Countless government offices are being set up all over the world. To help meet the need for equipment with which to furnish these centers, easily-packed desk sets are being molded of mottled brown cellulose acetate. 2—The loose-leaf calendar pad is injection molded while the calendar holder studs are extruded and then cut to length. Three parts comprise the blotter—the knob, the top and the rocker bottom. A blotter can be installed by loosening the knob and pushing the blotter between the top part and the rocker

PLASTICS IN REVIEW





1 While a soldier is in the field, he is often dependent for sustenance on whatever he is able to carry with him. This combination sustenance package and emergency flask of Lumarith E.C., molded by Master Plastics Molding Corp. is therefore a welcome addition to his kit because of its compactness, light weight and resistance to weathering. The removable cover of the flask telescopes over the top and is taped to the bottle after the dry contents are removed, making a waterproof flask. Directions are molded into the sides of the flask. The small container in the forground is a waterproof match case which fits inside the kit

2 Workers on large and complicated machines are provided with a new form of protection in these magnetic grip shields of Plexiglas, manufactured by Dilley Mfg. Co. Thick sheets of the plastic, anchored into a horseshoe permanent magnet, serve as a shield between the worker and his machine, deflecting flying fragments of steel, wood, etc., without obstructing vision. The magnet in the base of the shield holds it in position, yet is so arranged that it can be moved to more favorable positions by a slight twist of the mechanism

3 When reconnaissance planes return from a sortie over enemy territory to ascertain the amount of damage effected by the previous night's raid, their findings are carefully interpreted and tabulated by interpreter instruments of extreme accuracy and fineness of calibration. These instruments are manufactured by a special process which produces photographic reproductions on rigid Vinylite sheets fabricated by Photoplating Co. The plastic sheets are coated with a photographic emulsion, imprinted, then over-laminated with Vinylite resin film

4 Statistics are not available on the number of minor accidents sustained by people groping about in the unfamiliar darkness of a room in search of an elusive wall switch, but one can be certain that the figures are extensive. A vote of thanks is therefore in order for these LumiNite lighted wall switches, compression molded of antique ivory Plaskon by Yardley Plastics Co. The light shines through the plastic sheet from a bulb set in a small compartment behind the plate. It automatically goes off when the light switch is turned on and glows when it is off

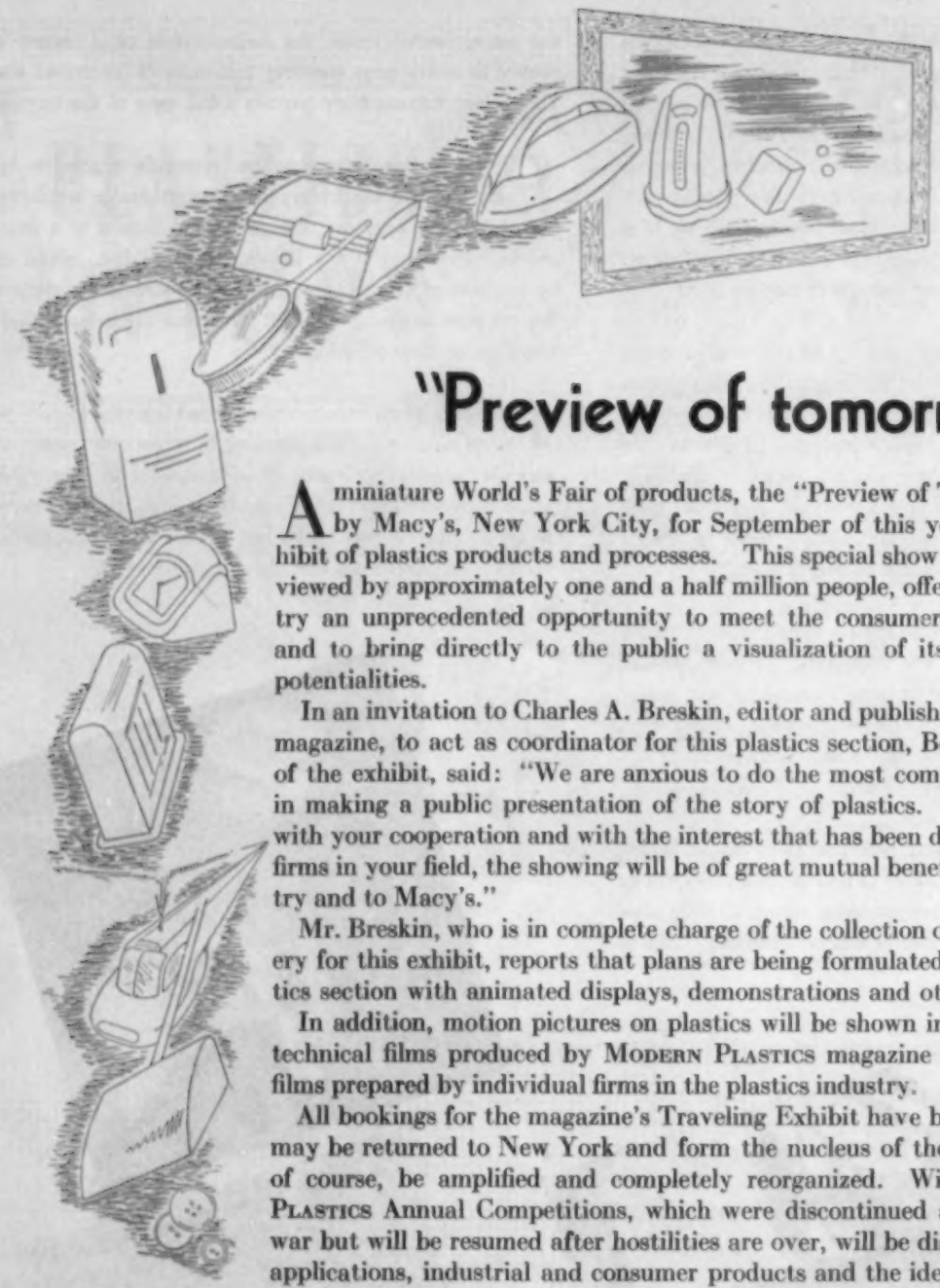
5 Rinsing vegetables and like items can become a very, messy task when the force of water from the tap splashes with greater force on the housewife than on the articles being cleaned. These faucet sprays, injection molded by BW Molded Plastics of bright red Tenite II, are designed with a number of small holes and a large center opening which is blocked by a removable cellulose acetate butyrate disk. When a steady stream of water is desired, the center hole is opened

6 Housewives who pride themselves on their culinary accomplishments will appreciate this shortening measure molded of Lumarith by Plas-Tex Corp. which provides a quick and accurate means of gaging quantities of shortening. The cups are molded in a six-cavity mold and three complete units can be produced in a single molding operation

7 The extremely high mortality rate prevalent among young children—especially tiny babies of premature birth—will be offset to some extent by these oxygen tents, weighing only nineteen ounces, which are fabricated of Ethocel sheeting. Still in the experimental stage, the tents consist of a center curved section of heavy gage sheeting and ends of laminated sheeting. Their clear transparency permits a full view of the tiny patient

8 Protective measures must be constantly applied to maintain and improve machinery functioning under a full-time war schedule. For example, the perforated bottom of a much-used sand-blast cabinet at the Ithaca Gun Co., Inc., when covered by a sheet of Compar, was made to increase its resistance to the constant drive of steel grit by almost three times that of the usual boiler-plate covering

9 In every circumstance where speed is a vital factor—whether it be on a ship, in a plane or in an engine room—its measurement must be constantly in evidence for checking and control. Elgin National Watch Co. houses its control clocks in high-impact Bakelite case molded by Barber Colman Co., which are shock-resistant and impervious to oils and greases



"Preview of tomorrow"

A miniature World's Fair of products, the "Preview of Tomorrow," announced by Macy's, New York City, for September of this year, will feature an exhibit of plastics products and processes. This special show which is expected to be viewed by approximately one and a half million people, offers to the plastics industry an unprecedented opportunity to meet the consumer as he goes to market and to bring directly to the public a visualization of its accomplishments and potentialities.

In an invitation to Charles A. Breskin, editor and publisher of MODERN PLASTICS magazine, to act as coordinator for this plastics section, Bert Bacharach, director of the exhibit, said: "We are anxious to do the most comprehensive job possible in making a public presentation of the story of plastics. We are confident that with your cooperation and with the interest that has been displayed by the leading firms in your field, the showing will be of great mutual benefit to the plastics industry and to Macy's."

Mr. Breskin, who is in complete charge of the collection of products and machinery for this exhibit, reports that plans are being formulated to dramatize the plastics section with animated displays, demonstrations and other special features.

In addition, motion pictures on plastics will be shown including the three non-technical films produced by MODERN PLASTICS magazine and other educational films prepared by individual firms in the plastics industry.

All bookings for the magazine's Traveling Exhibit have been cancelled so that it may be returned to New York and form the nucleus of the Macy show. It will, of course, be amplified and completely reorganized. Winners of the MODERN PLASTICS Annual Competitions, which were discontinued at the outbreak of the war but will be resumed after hostilities are over, will be displayed along with war applications, industrial and consumer products and the ideas of leading designers for peacetime plastics products.

Following its appearance at Macy's, the "Preview of Tomorrow" show will travel throughout the United States where it will be on display to several million more potential customers.

According to present plans, Macy's will supply suitable backgrounds for the displays and will take an active part in cooperation with Mr. Breskin in the actual physical production and planning of the Plastics Section. All plastics manufacturers are urged to cooperate in the development of this special section.

While the opening of this exhibit has been tentatively set for September 4, 1945, it is impossible to set an absolute date on a project so dependent on the course of the war. Macy officials voluntarily postponed an opening schedule for May 1945 in order to cooperate with Government requests. It is hoped that there will be no subsequent postponement of this important and highly educational exposition.

Further details regarding specific projects will be announced as progress is made in accumulating displays and outlining the program. An open invitation is extended to all members of the plastics industry and to all who have produced or designed plastic products to participate in this exhibit. Inquiries, suggestions, samples, etc., should be addressed to Charles A. Breskin, Modern Plastics, Inc., 122 E. 42nd St., New York 17, N. Y.

PLASTICS*
Engineering Section
• F. B. STANLEY, Editor

The T-44 frangible bullet

EARLY in the war it was always a question just how troops would react to their first taste of actual combat. Would they freeze up, lose their heads? Would they be able to carry through against live, moving targets the instructions they had tried so often on stationary targets or with blanks?

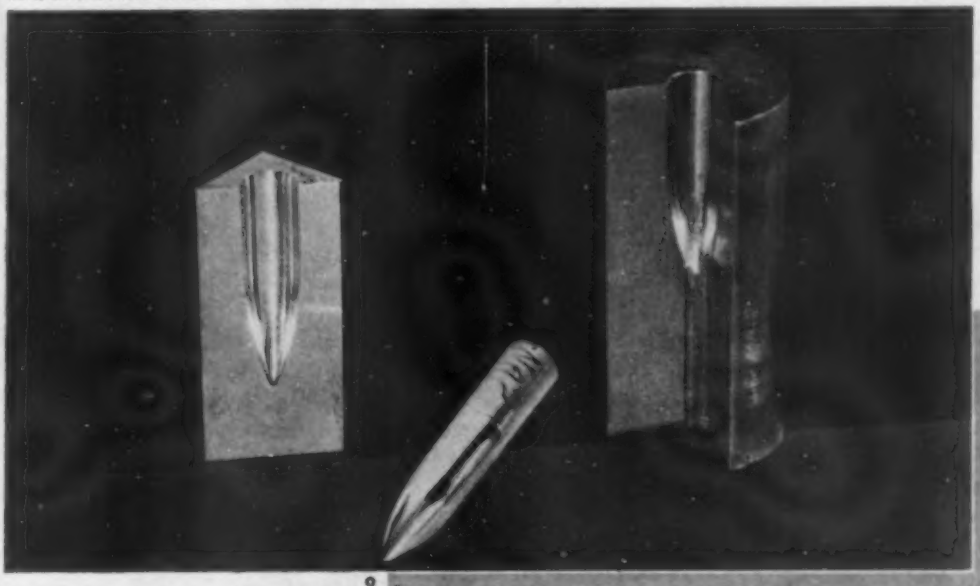
In the Air Forces, those charged with the training of pilots, bombardiers and navigators could easily duplicate the tasks these men would perform during actual missions over enemy territory. But simulating the work of the gunners was another matter. These boys might fire upon targets in the tow of another plane, they might aim at another ship and pretend to fire, and it would still remain for them to learn their job when they first encountered the enemy, when they couldn't afford to be learning.

Such was the condition until May 29, 1944, when for the first time a student gunner fired a live bullet at a real plane flown by a live pilot. On that day the frangible bullet, molded of plastic and lead, was first tried out.

This frangible (breakable) bullet is the result of the obstinate belief of Major Cameron Fairchild, Army Air Forces, that it was somehow possible to shoot a live bullet at a live target without hurting the target. With the permission of the proper authorities, Major Fairchild experimented with pellets of tempered glass in which the molecular cohesion is such that it disintegrates into a fine powder when the sensitive tip is shattered. A successful glass bullet was finally produced, but it proved to be too costly.

Before long the Army Air Forces; the National Defense Research Council; Dr. Paul Gross, Director of Research of Duke University; and the research chemists of the Bakelite Corp. at Bound Brook, N. J., were hard at work on a lead and plastic bullet that was hard enough to take the hammering

PHOTOS 1 AND 2 COURTESY NEWARK DIE CO.
NO. 2, OFFICIAL PHOTO U.S. AAF., BY AAF TRAINING COMMAND



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1—Hobbing proved the most economical method of producing the cavities for the frangible bullets

2

2—Two of the new bullets, one of which has been broken apart near the tip. The powder in the center was obtained as the result of firing a quantity of this practice ammunition

* Reg. U. S. Pat. Office

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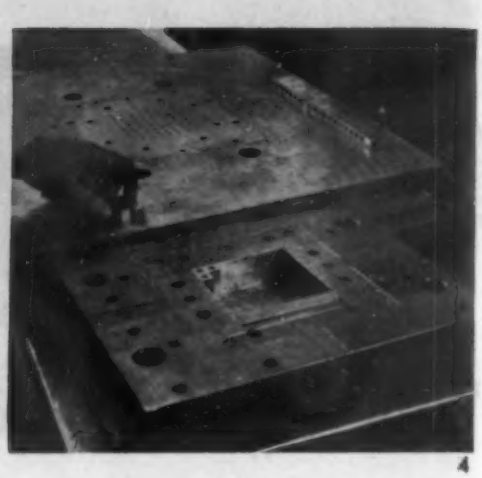

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of a 30-caliber machine gun yet fragile enough to crumble into fine powder upon impact with a target. The only limitation on the use of the bullet which evolved from the year and a half of research work is the need for a specially treated duralumin armor on the target plane. On such a surface the bullet leaves only a slight smudge even at point-blank range.

The Ordnance Department was assigned the responsibility of procuring frangible slugs in accordance with Air Corps developments on August 31, 1944, at a meeting held in Frankford Arsenal in Philadelphia and attended by representatives of Frankford Arsenal; the Ammunition Branch, Small Arms Division; the Small Arms Division (Washington); the Air Forces; the National Defense Research Council, Bakelite Corp.; Shaw Insulator Co.; Boonton Molding Co. and the Remington Arms Company.

The purpose of this meeting was to familiarize the Ordnance Department with the development work that had preceded the meeting and to establish requirements desired by the Air Corps. Ordnance plants were instructed to develop molding capacity as quickly as possible for enough frangible slugs to meet their requirements for finished cartridges. The Boonton Molding Co. and Shaw Insulator Co. formed the nucleus of this group since these two concerns were familiar with the project from the development standpoint.

Two experimental multiple-cavity molds were on order by the National Defense Research Council with the Newark Die Company. One had been assigned to Shaw Insulator Co. and the other to Boonton Molding Co. by the NDRC for purposes of further experimentation with the production in multiple-cavity molds. However, the immediate requirements of the Air Corps made it necessary to forego experimentation and to utilize these molds for the initial production.

On Sept. 26, 1944, the Ammunition Branch, Small Arms Division, held a meeting with the National Defense Research Council, Frankford Arsenal and the Bakelite Corp. to establish responsibilities in connection with production and basic specifications. The responsibilities were defined as follows:

a. The Ordnance Department is responsible for producing a cartridge which is satisfactory for Air Corps' use and in quantities sufficient to meet their requirements.
b. The prime contractors are responsible for the purchase of the bullets and the manufacture of cartridges in accordance with Ordnance Specifications.
c. The plastic molders are responsible for producing bullets which will meet the requirements of prime contractors.
d. The Bakelite Corp., is responsible for producing a mix which will be used to manufacture the bullets in accordance with specifications developed by NDRC.

Visual and gaging standards were established for the plastic slug.

On Oct. 2, 1944, another meeting was held, this time in the office of the Ammunition Branch, and was attended by the prime contractors and by representatives of the companies that had, to date, undertaken the molding of the frangible bullets. These included the Boonton Molding Co., Compression Molding Co., Consolidated Molded Products Co., Mack Molding Co., Pal Tool Co., Plastic Engineering, Inc., Shaw Insulator Co., Universal Plastics Corp. and the Woodruff Company.

Through vigorous expediting by the Ammunition Branch, Small Arms Division; by the Small Arms Ammunition Plants; and by the frangible bullet molders, sufficient molds were made available. The five millionth frangible bullet slug was shipped by one of the molders to a prime contractor on December 18, 1944.

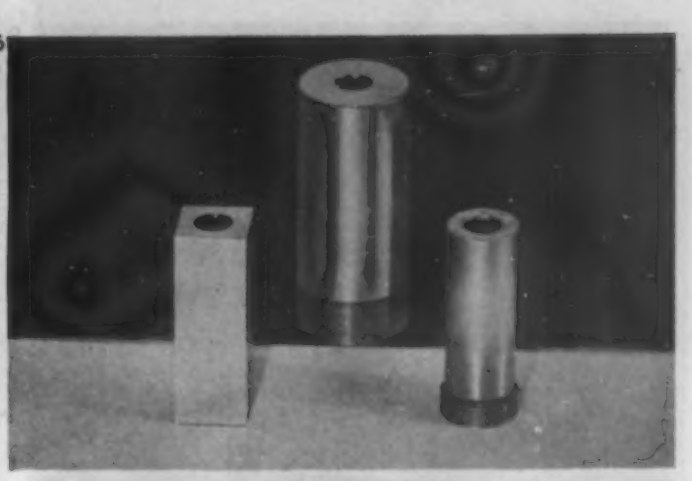
It was the consensus of opinion among the group that an Industry integration committee should be formed which would enable plastic molders to collect, correlate and analyze information; make recommendations concerning the product to the Ordnance Department; and generally seek solutions to any and all problems that might arise during the ensuing months. The committee was formed and the following officers appointed: chairman, Brig. Gen. Ben. J. Kirk, Chief, Small Arms Div., Office, Chief of Ordnance, Washington, D. C.; deputy chairman, Lt. Col. Miles B. Chatfield, Chief, Ammunition Branch, Small Arms Div., Philadelphia, Pa.; assistant chairman, George K. Scribner, Boonton Molding Co.

Through the efforts of the Industry Integration Committee and the prime contractors, 13 frangible bullet molders were selected with hydraulic press capacity sufficient to meet monthly requirements. These molders are listed below.

Company

Boonton Molding Co.
Compression Molding Co.
Consolidated Molded Products Corp.
Grigoleit Co.
Industrial Molded Products Co.
Mack Molding Co.
Molded Products Co.
Pal Tool Co.
Plastic Engineering, Inc.
Shaw Insulator Co.
Universal Plastics Corp.
Waterbury Companies, Inc.
Woodruff Co.

5



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The problems in procuring molds were concerned purely with expediting the work. In the main this involved procuring labor for the Newark Die Company. The mold manufacturers were Newark Die Co., Pal Tool Co., Western Cartridge Co., Phillips Drucker Co., Midland Die Co., Columbia Engineering Co., and the G & S Tool Company.

The experience of the Newark Die Co. indicated that the best and most economical method of producing the cavities for these bullets was by hobbing. Hobs were made of high-speed steel held in a special fixture to avoid breakage due to the length of the piece. The company found it necessary to develop a special hobbing technique in order to use successfully oil-hardening tool steel.

The molding material of which the frangible bullet is composed exhibits a tendency to stick when molded in unprotected steel molds. It was found, however, that this condition could be eliminated by the application of a 0.0002 to 0.0003 in. plate of hard chromium on all of the mold surfaces coming in direct contact with the material during the molding operation. Therefore, the force, pot, sprue plate, cavities and cavity retainer plate on all molds are hard chromium plated with the result that many thousand heats can be produced without costly shutdowns for arduous and extensive cleaning of the mold. The molding material wipes off readily from the hard

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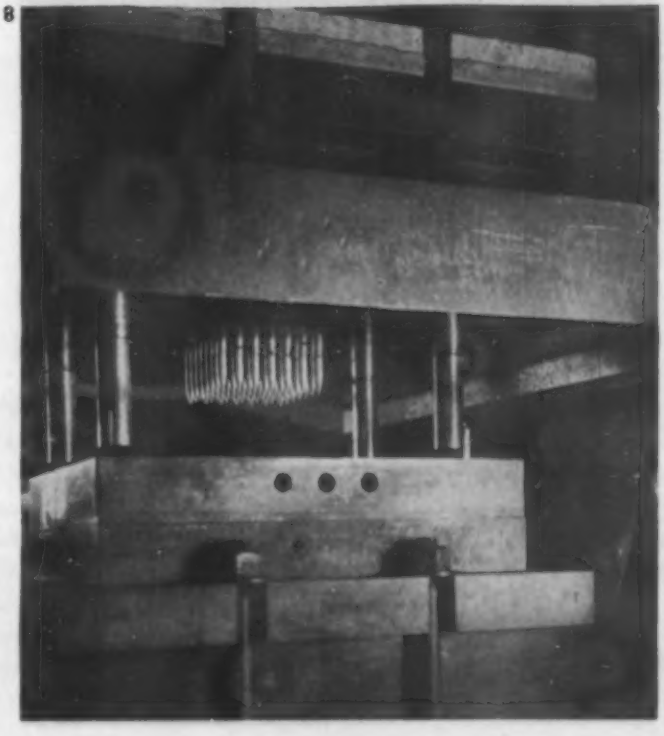

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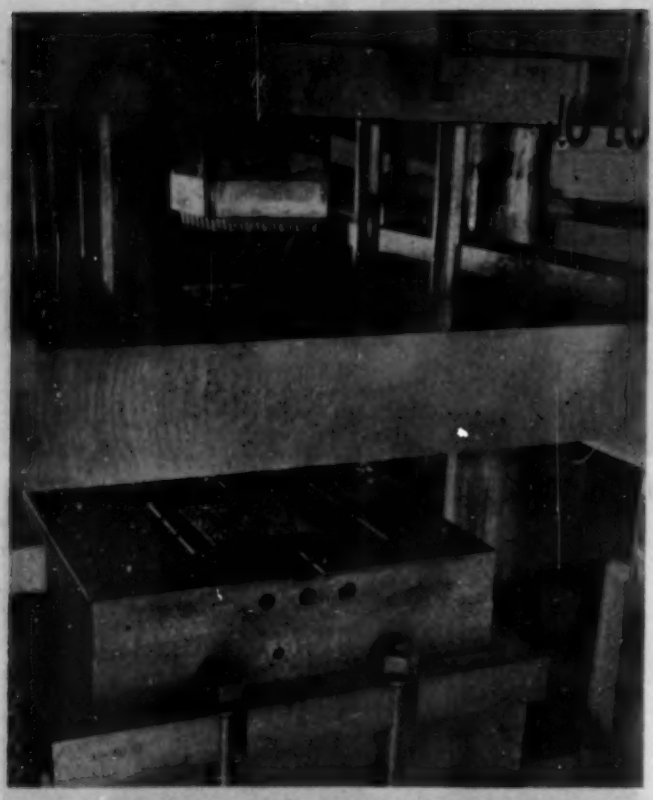
3—The orientation of the material which results from the transfer molding of the frangible bullet slugs is clearly indicated in this photograph which includes parts taken from the cavities at various stages in the molding process. The slug at the left was removed when the cavity was almost filled, while the part at the right was taken from the cavity when the compound was only beginning to flow. 4—One of the first molds used for the production of the frangible bullet, the 49-cavity square layout, was designed so that worn-out cavities could be replaced easily. 5—Easy replacement of cavities was also a feature of this 61-cavity mold. 6—Left, a square-type cavity used for the square mold layout; right, a shouldered circular cavity used in the circular mold. Unfinished hobbing, center. 7—In some plants, preforms—like the three being loaded into the transfer pot—are used instead of powder. 8—As the cavities in the square-type mold drop away from the bullet slugs, the parts hang suspended from their gates until they are stripped by the continued motion of the press when the bolster plate moves away from the transfer plunger



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chromium plate, and no serious adhesion of the material to the mold components has been experienced by those engaged in the production of the plastic bullet.

It is felt that the universal use of hard chromium plated mold surfaces in this project is also of considerable value in other respects, although no comparable figures are available. The quality of bullets produced in the same plated cavities over a schedule of many thousand heats has remained excellent both from the standpoint of appearance and dimensions thus indicating the high wear-resistance of the plated cavity surface. The application of controlled hard chromium plate to the machined or hobbed cavities is also of assistance in meeting the rigid dimensional requirements in that, by controlling the thickness of the plating, the cavity diameter can be much more uniformly produced than would otherwise be feasible.

The chrome plating of a narrow opening with a blind hole presented a number of difficulties. For example, where a number of cavities are chrome plated simultaneously, the anodes are centered in the cavities. If these anodes slip off center, the cavities are damaged, since the chrome plate builds up on one side of the ogives and forms small humps. When this happens the cavities are useless and must be scrapped. They cannot be recovered because it is not practical to strip them of the faulty plating. The Industrial Hard Chromium Co. tackled the problem and developed special fixtures and anodes which have done much to solve the problem.

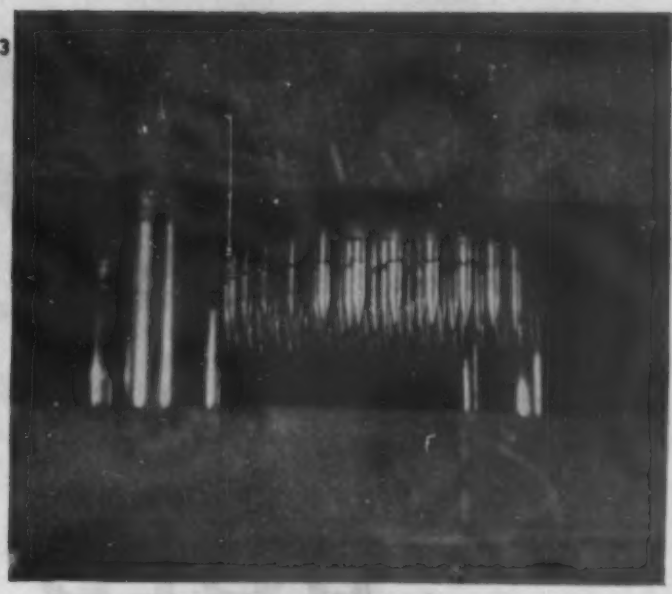
When this bullet job was taken from the experimental stage and presented to the plastics molding industry with requirement figures for the first ninety days, little production molding information was available. Some of the characteristics of the material indicated that it was impossible to mold in large production molds. Whereas a normal phenolic filled material has a flow characteristic of 4 in. at 600 lb. pressure, this lead-filled phenolic showed up with 0.6 in. flow at 1000 lb. pressure. As one molder stated, the decision as to the proper size of the mold was a pure gamble.

On the other hand, the decision as to the method of molding was practically a foregone conclusion due to the poor strength characteristics which showed up in compression-molded slugs. Study indicated that the weakness of these parts resulted from stratification during the molding. Transfer molding, however, produced slugs with the proper characteristics due to the orientation of the entering compound.

A study of Fig. 3 will show the orientation which resulted from the transfer molding process. It will be noted that after the entering ribbon of compound is stopped on the bottom of the cavity, it winds up in spiral form to fill the cavity. When the cavity is completely filled, pressure blends the spirals into a uniform mass. The parts at the left of Fig. 3 were removed when the cavity was almost completely filled while the pieces on the right show only the beginning of the flow. Two completed bullets are in the foreground.

9—This 49-cavity mold was designed to effect a reduction in the cull or waste. 10—As a result of a change in the shape of the 61-cavity mold, from a circular to a hexagonal pattern, a marked reduction in the size of the cull was effected. The lefthand piece indicates the size of the cull when the mold was circular in shape; the righthand piece, the cull after the change. 11—The problem of moving heavy containers of molding compound was solved in one plant by the development of a semi-automatic system which measures a predetermined amount of material and deposits it in the loading fixture

12



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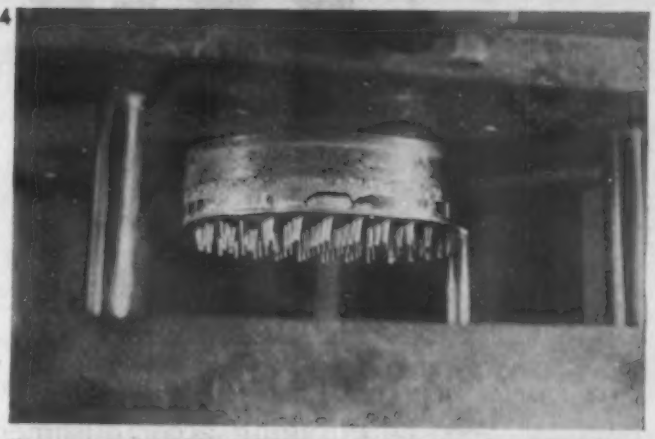

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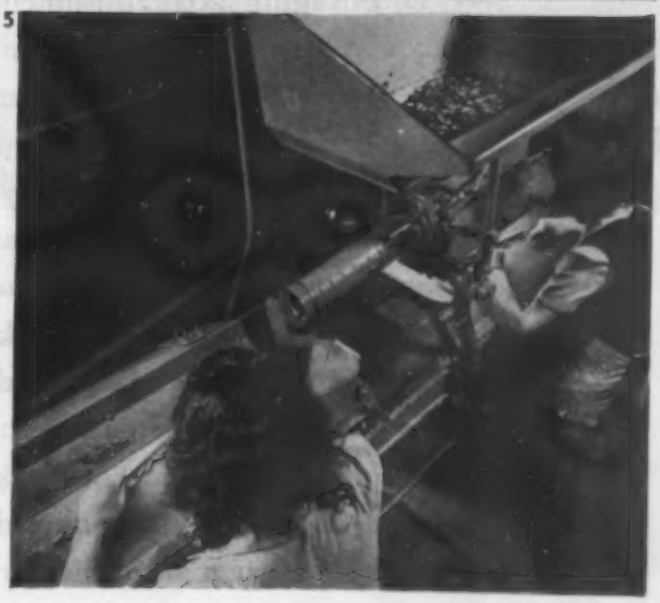

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One of the first molds was a 49-cavity square layout with chase and cavities as shown in Fig. 4. The molder had several reasons for selecting this type of layout. Inasmuch as the specifications of the bullet called for extremely low dimensional variables, almost absolute control of density and perfection in surface texture, the mold design had to be just right if rejects were to be kept to a minimum. With this mold design, cavities could be made as individual units, easily clamped into a mold shoe or chase, and as easily replaced should one or more cavities start producing rejects. If replacement cavities were not available, the defective cavity could be turned upside down—blocking off that particular sprue. This method of operation did away with the need for carefully removing one or more poorly molded bullet slugs from each shot.

Another of the early molds was designed with 61 cavities merely because, as the molder stated, 61 cavities were standard for a circular mold. In this mold, shown in Fig. 5, round-shouldered cavities were assembled in a circular cavity plate. This design also permitted easy replacement of worn-out cavities. Figure 6 shows a finished square-type cavity used for the square mold layout and, at the right, a shouldered circular cavity used in the circular layout. The part in the center of this photograph is an unfinished hobbing.

The molding technique is probably just about the same today as it was when the first two molders actually got into production. However, there are slight variations from molder to molder. For example, some companies use preforms while others use powder.

A good example of the preform technique is shown in Figs. 7, 8 and 9. In Fig. 7, the operator is loading three preforms into the transfer pot. The molder using this procedure states that while normally no preheating is necessary, it is advantageous in the winter time to employ slight infrared heat in order to bring the pellets up to room temperature. Normally, however, if the preforms are held at room temperature, no preheating is necessary. After the mold is closed and the material transferred, 80 sec. are permitted for curing. This short cure is made possible by the high thermal conductivity of the compound which is 90 percent lead and 10 percent phenolic. This heat transfer is, of course, a lot faster than normal phenolic materials.

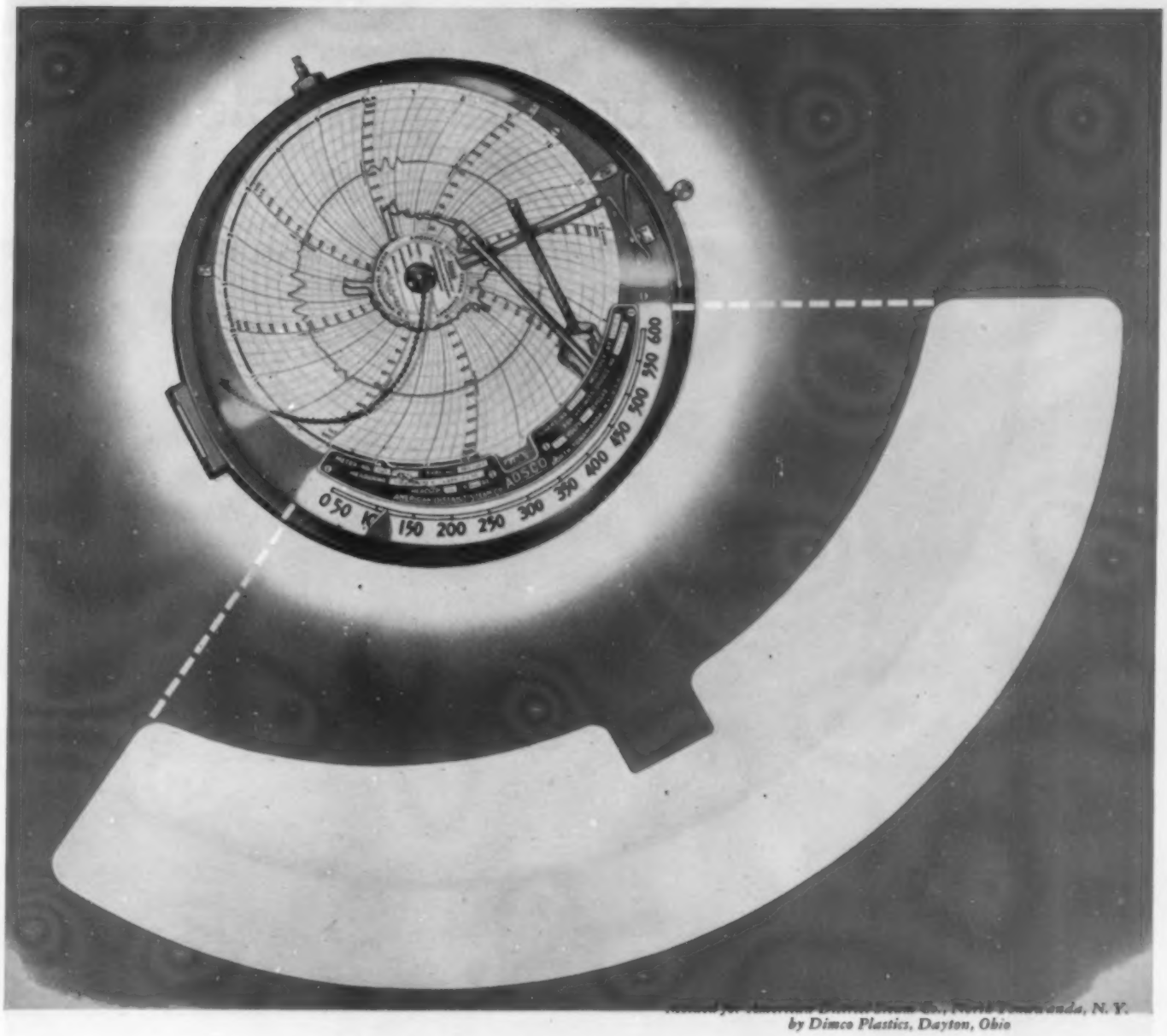
Figure 8 shows the square-type mold just after the cavities have dropped away from the (*Please turn to page 198*)

***12**—A fixture loaded by the machine shown in Fig. 11 is here being placed in position over the transfer pot.* ***13**—A shot of bullets as it appears just before being stripped from the circular mold.* ***14**—Cull that remains when circular mold shown in Fig. 13 is used.* ***15**—This inspection machine will handle many sizes and shapes of small objects. Two scraper bars mounted above the moving belt serve to agitate the slugs so the operators can inspect the bullets from all angles*

BOLD SCALE

IN AMERICA'S important task of coal, gas and oil conservation, a major requirement is the detection of waste and inefficiency. Encouraging accomplishments have been made with the aid of highly accurate flow meter equipment such as shown at the right, which supplies a 24-hour visual record of steam consumption, steam pressure, and amount of steam passing through the line. Much of this information is indicated on big, boldly-visible Plaskon Molded Color scales, upon which the meter markings are printed. Under all conditions these markings can be quickly, easily and accurately seen. Illumination behind the translucent Plaskon unit makes the entire scale glow brightly, so that each number and word stands out in sharp contrast. Plaskon also gathers the light from outside sources. This is one of the many efficient industrial services of Plaskon. Because of its versatility, Plaskon has aided in the development and manufacture of important products for the battle front and home front. It is a strong, non-shattering

PLASKON DIVISION, LIBBEY · OWENS · FORD GLASS CO., 2121 Sylvan Avenue, Toledo 6, Ohio



by Dimco Plastics, Dayton, Ohio

material, with a smooth surface, and is available in a complete range of colors. It is unaffected by oils, fats, or common solvents; and is completely resistant to arcing or tracking under high voltages and high frequencies. Plaskon Molded Color offers you a great range of manufacturing and sales advantages, both for present and postwar requirements. Experienced Plaskon men will gladly assist in adapting this versatile, colorful plastic molding material to your needs.

In Canada:
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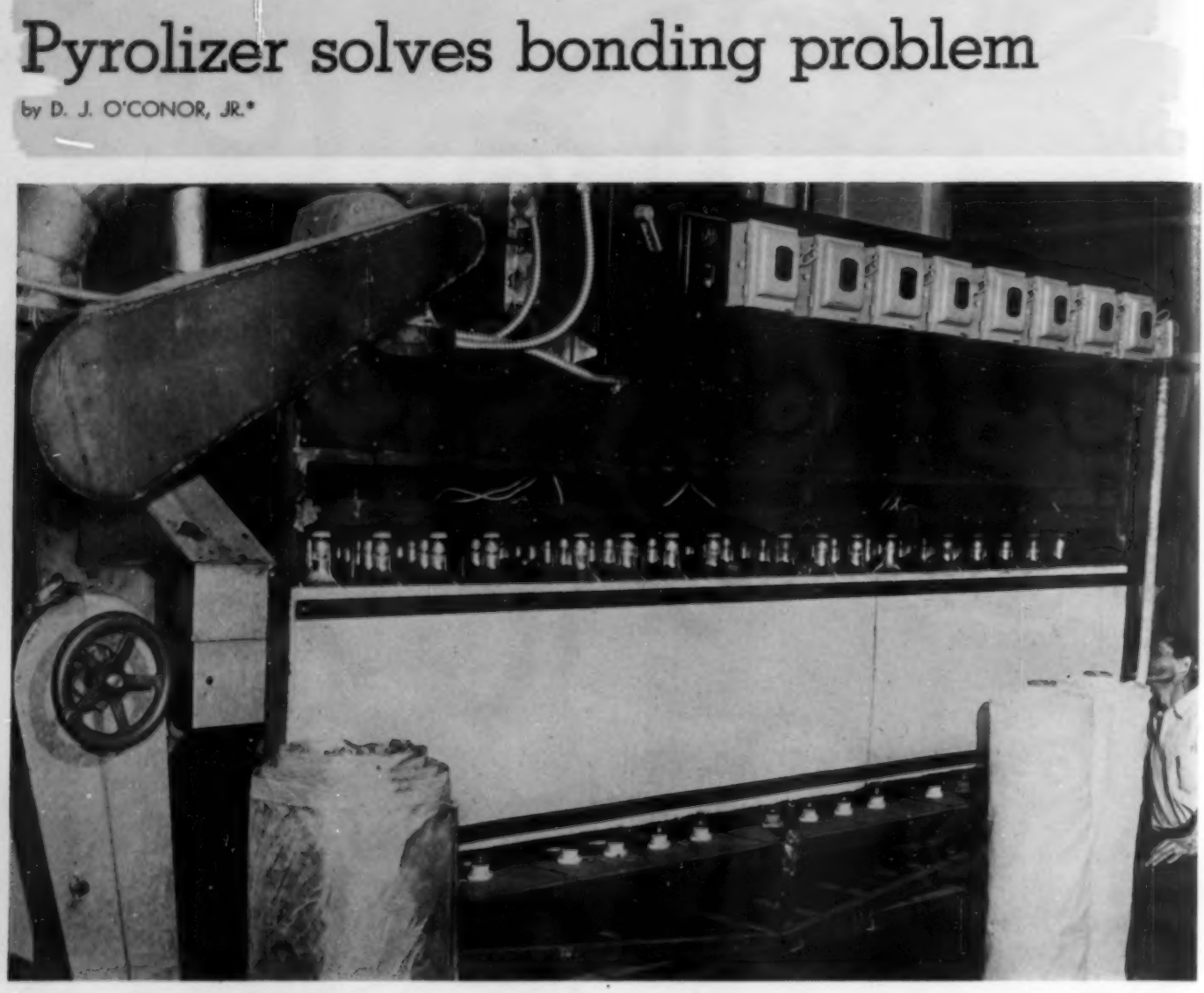
PLASKON

TRADE MARK REGISTERED

MOLDED COLOR

Pyrolizer solves bonding problem

by D. J. O'CONOR, JR.*



1—Essentially, the Pyrolizer consists of two banks of 125-watt infrared bulbs. One bank of 170 bulbs is set above a 4½ ft. wide, 10 ft. long metal sheet which forms the top of a slot. The other bank of bulbs is set below a similar metal sheet which forms the bottom of the slot. The glass fiber fabric, passing through the slot, is subjected to a temperature in excess of 400°C.

IN manufacturing the new fire- and arc-resistant glass-fiber[1] melamine laminate[2] recently specified for use as panel-board material on Navy ships, a major problem, now successfully solved, was the securing of a firm bond between the glass-fiber fabric used as the base of the laminate and the melamine resin.

From 1942 to 1943, that is, during the early stages of the development of the new laminate, which has been under the direction of a committee of manufacturers set up by the Navy Department Bureau of Ships, intensive research was carried out on the treatment of the glass fabric as a means of securing the desired bond. None of this research produced significant results and it was then decided that the best procedure was to use the fabric without treatment. This resulted in a better laminate than any then available for panel-board use. However, experience showed it to be one which was rather easily delaminated.

For some time engineers of the company supplying the glass fabric had been working—on a pilot-plant scale—with heat-treatment of glass cloth as a means of increasing the strength of the bond in the final laminate. Our engineers undertook the development of equipment to mass-produce this treated glass fabric. By the spring of 1944 they had developed a unique treating machine, known as the Pyrolizer, which made possible the doubling of the strength of the bond. At the same time there was a corresponding improvement in all mechanical properties.

The Pyrolizer (Fig. 1) consists essentially of two banks of 125-watt infrared bulbs. One bank of 170 bulbs is set above a 4½ ft. wide, 10 ft. long metal sheet which forms the top of a slot. The other bank, with the same number of bulbs, is set below a similar metal sheet which forms the bottom of the

* Assistant chief engineer, The Formica Insulation Co.

[1] Fiberglas. [2] See "A safeguard against shipboard fires," MODERN PLASTICS, 22, 126–127, 214 (March 1945).

slot. The space between the metal sheets is $1\frac{1}{4}$ in. wide. The glass fiber fabric, passing through the $4\frac{1}{2}$ ft. wide slot at a rate of 20 ft. per min., is subjected to a temperature which is in excess of 400° C.

On entering the slot the fabric is in contact with the front edge of the lower metal sheet. When passing out of the slot it is in contact with the rear edge of the upper metal sheet. Thus the cloth itself shuts off all draft through the slot (Fig. 3). The absence of draft in the space between the metal sheets results in a higher temperature and a more even distribution of heat.

The high temperature does not impair the strength of the glass fabric, but it burns off practically all of the lubricant which is added to the glass fibers during the forming process to give them the handling qualities that permit them to be twisted and plied into yarns which are subsequently woven into fabrics (Fig. 2). Four-tenths of one percent of caramelized lubricant is left upon the fabric. This residue gives the treated glass fabric a copper color and contributes to the securing of maximum adhesion with the melamine resin.

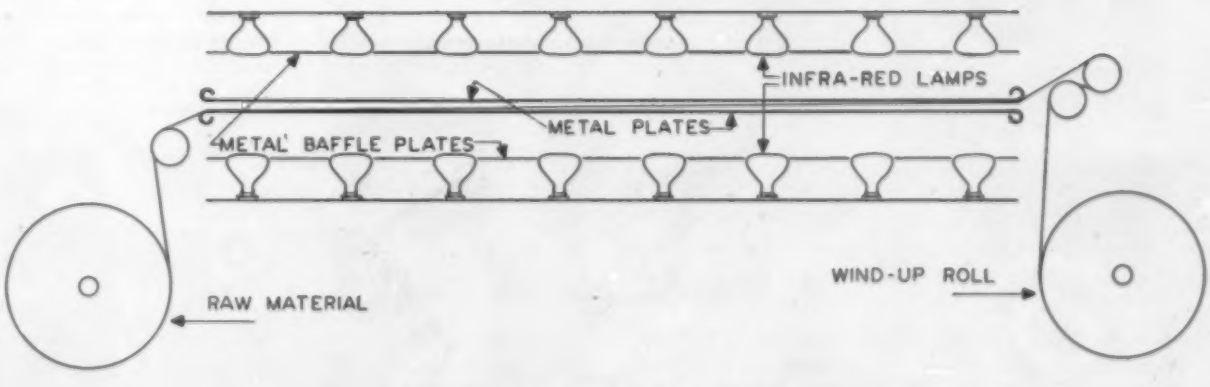
The original use of untreated glass-fiber fabric as a base resulted in a white panel board. This was objectionable because the white board frequently got dirty during fabrication and installation, and was difficult to clean. Methods of dyeing the fabric or the board were sought—unsuccessfully. The Pyrolizer has solved this problem by giving a copper color to the treated glass fabric used as a base for these panels. The present brown panel board does not show soil easily and the question of cleaning does not arise.

The design of the Pyrolizer has been made available to other laminators, and it is now widely used in treating glass-fiber fabric for use as the base for the glass-fiber melamine panel board that is now being specified for use on all types of ships for the Navy.

2

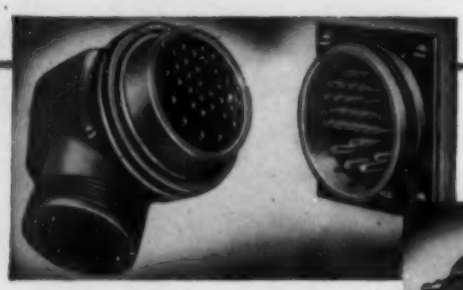
2—The high temperature of the machine burns off practically all the lubricant which is added to the glass fibers during the forming process.
3—On entering the slot the fabric is in contact with the front edge of the lower metal sheet. Passing out, it is in contact with the rear upper edge

3

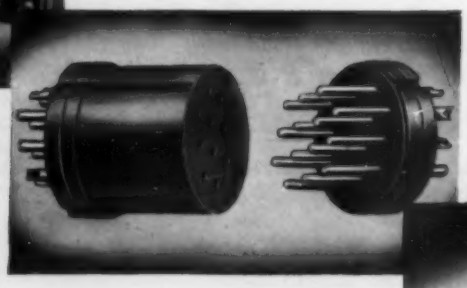


INFRA-RED PYROLIZER

Melmac...*the Plastic*



AND SOME OTHER USES FOR MELMAC



MOLDED MELMAC INSERTS do not have to be tropicalized. Their high arc resistance under all conditions will permit them to function under the most adverse service requirements.

to "Serve" a Nation

Sets of MELMAC* food service are sailing the seas, flying the skyways, and serving in mess halls and hospitals, because MELMAC is light in weight and hard to break, is clean, sanitary, odorless and tasteless!

Typical are these Plastic Food Containers, designed by Devine Foods, Incorporated, Chicago, for hospital and institutional use. Molded of Cyanamid's chopped-cotton-fabric-filled MELMAC, they have good insulating properties to keep food either hot or cold, excellent resistance to moisture absorption, and high strength.

MELMAC alpha-cellulose-filled molding material is also widely used for tableware, buttons, and housings, where resistance to weather, moisture, and chemical attack is important, and where availability of color is a factor!

Mineral-filled MELMAC parts have the advantages of high arc resistance, excellent insulation resistance, and very good dimensional stability under varying temperature and moisture conditions.

Be sure to investigate the opportunities for design and product improvement with these new plastic materials. Further information is available in our handbook, "MELMAC MOLDING COMPOUNDS," and we will also be glad to work with you on new designs and applications.

Reg. U. S. Pat. Off.

AMERICAN CYANAMID COMPANY · PLASTICS DIVISION
30 ROCKEFELLER PLAZA · NEW YORK 20, N. Y.

Cyanamid Plastics

Beetle · Melmac
Melurac · Laminac · Urac

MELMAC BUTTONS are smooth, attractive, and serviceable, and stand up under repeated laundering and dry cleaning. They can be molded at low cost with complete assurance of accurate dimensions, uniform strength, and unvarying color. A variety of colors is available.

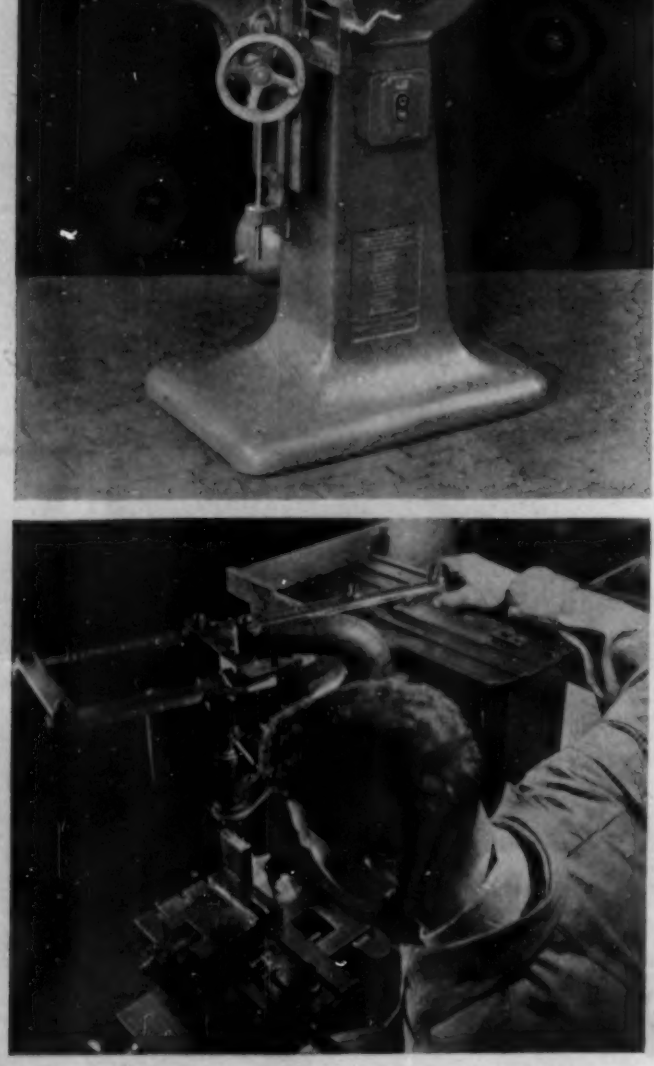
MELMAC DISTRIBUTOR PARTS add to the life and efficiency of commercial type magnetos for tractors, stationary engines, and similar heavy-duty power plants, because of MELMAC's uniformity of insulating properties, good arc-tracking resistance, and stability under such adverse service conditions as exposure to moisture, dust, and dirt.

Engraving of molds

by ISLYN THOMAS* and RICHARD KOEGL**

1

2



3

THE engraving of master hobs and cavities in the early days depended solely on the ability and skill of hand engravers. To acquire the requisite training and skill a prospective hand engraver must go through a long and tedious apprenticeship under the watchful eyes of the master craftsmen. Many good men are lost during the training period due to low wages which force them into other fields where the training period is not so long. But even so, the apprentices who complete the strenuous training period are usually those with creative ability and artistic inclinations. The net result, however, has been a shortage of skilled hand engravers throughout the entire history of the industry.

The shortage of skilled hand engravers (Fig. 1) was somewhat relieved with the advent of special engraving machines. Using this equipment it is now possible, on certain types of work, to achieve the same results as from hand work and to achieve them more uniformly and considerably faster. First, however, master patterns must be made and set up.

With the pantograph engraving machine (Fig. 2) it is possible, in many instances, to employ an operator with far less training and considerably less artistic ability than is required of an old-time skilled hand engraver. But even with the addition of these new and improved engraving machines a shortage of skilled hand engravers continues to exist and threatens to become more critical during the postwar era when the demand for well-made articles and molds will increase because of the inevitable competition which will arise.

To make matters worse nearly all the young apprentices have been inducted into the Armed Forces or have taken other jobs more essential to the war effort. Whether these boys will take up where they left off in their training is questionable. Those who have taken other jobs may be rather reluctant to make another start at apprentice wages after becoming accustomed to higher wages.

The solution seems to lie in making the most advantageous use of the skilled hand engravers who remain. Why do certain kinds of engraving work by hand when an engraving machine manned by an efficient operator can do the same thing just as well and possibly more economically? The following discussion is intended to clarify doubts as to which items should be machine engraved, which should be hand engraved and which should be engraved using a combination of both, so that the engravers' skill may be used to best advantage.

Machine engraving

Machine engraving is accomplished by means of pantographic mechanical contrivances using motor-driven rotary cutters. The machines are built very sturdily with microme-

* President, Thomas Engineering Co.
** President, R. A. Koegl Stamp and Die Works.

1—Intricate hobs such as this for a miniature plane are typical of the work done by hand engravers. 2—Pantograph engraving machines have, in some instances, replaced the hand engraver and relieved the critical situation resulting from the shortage of these skilled men. 3—The 2-dimensional pantograph, shown here, is best suited to the engraving of letters and designs

FIGS. 5, 6, AND 6, COURTESY GEO. GROTON MACHINE CO.

4

5

6

4—While these machine-engraved samples could be engraved by hand the results would probably be less accurate and the work would be more time consuming. 5—When these pantograph machines are used on concave, convex or spherical surfaces, a forming guide must be used. Here such a guide is mounted over the revolving cutter spindle. 6—A 3-dimensional pantograph is needed for the engraving of seals and insignia. 7—An assortment of cutter points and the cuts which they make

ter adjustment for precision work and are generally equipped with adjustable pantographic ratios so that the equipment can be adapted to hundreds of different applications.

There are two main types of machines in use. One is called a 2-dimensional pantograph, the other a 3-dimensional pantograph. Both have advantages and disadvantages as compared to hand engraving.

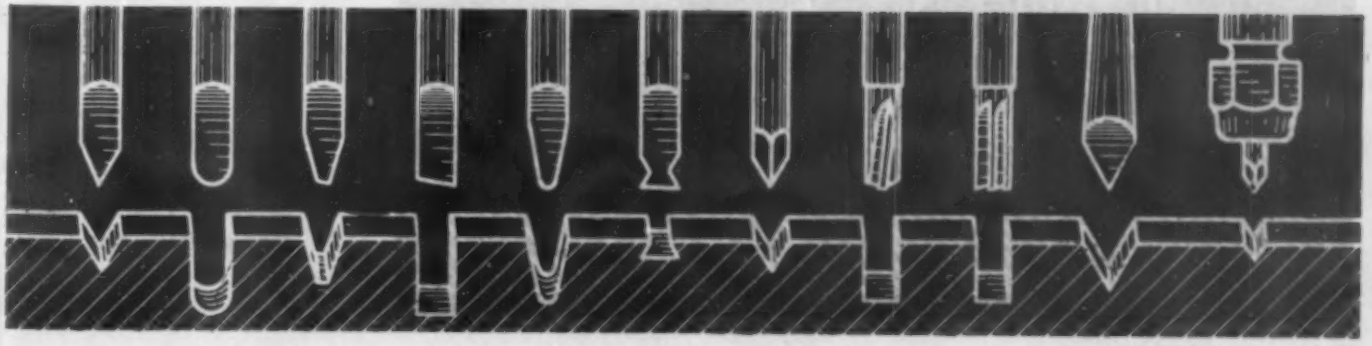
Two-dimensional pantograph—For the engraving of letters and designs, a 2-dimensional pantograph (Fig. 3) should be used. The operation is quite simple after the enlarged master templet or copy is set up in the copy holder of the machine. The tracer, guided by the machine operator, follows the copy. Since the lateral movement of the revolving cutter duplicates that of the tracer, the copy is reproduced in the job being engraved. The machine-engraved samples shown in Fig. 4 could be engraved by hand but, in all probability, this latter method would be less accurate and slower.

The copy is generally made up of standard brass letters or type set up in a holder and fastened to the machine. If special designs are required, the copy or masters are generally made of either brass, steel or celluloid.

In addition to working on flat surfaces, these machines can operate on concave, convex and spherical surfaces if the curvature is uniform and within certain diameters. In conjunction with the regular flat copy or master templet, a form-

ALL DRAWINGS, COURTESY THOMAS ENGINEERING CO.

7 FIGS. 1, 2, 4, 8, 9, 10 THROUGH 19, COURTESY R. A. KOEGL STAMP AND DIE WORKS.



8

ing guide is also used for curved work (Fig. 8). This guide is made of hardened tool steel and should have a curvature exactly opposite to that of the work being cut. For instance if the work is convex the forming guide should be concave. Before using, the contour of the guide should be matched with the part to be engraved.

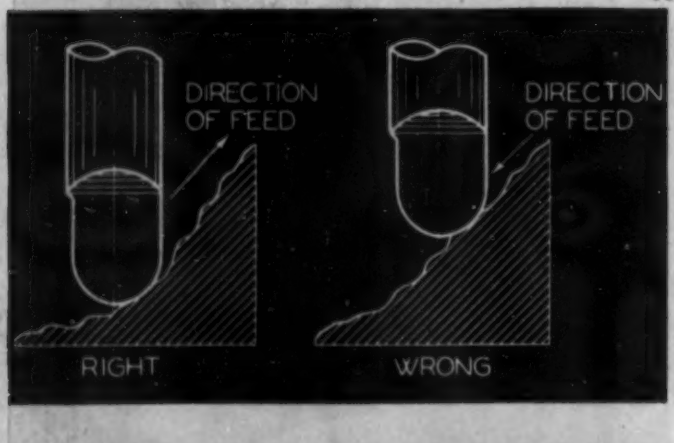
The hardened forming guide, as shown in Fig. 5, is mounted over the revolving cutter spindle. The former point, which is fastened to the spindle, is held secure against the forming guide by the pressure of the spring in the spindle. To reduce friction between the former point and forming guide it is best to cover the surface of the guide with a film of grease. With this setup the revolving cutter will then follow the curvature of the forming guide giving an exact opposite curvature to the work being cut.

Three-dimensional pantograph—For engraving in three dimensions from enlarged models of any shape or contour, a 3-dimensional pantograph (Fig. 6) is required. This machine is also capable of performing the work done by a 2-dimensional pantograph.

9

For this 3-dimensional work a modeling bar is used, as shown in the center of Fig. 6. This bar, connecting the tracer spindle and cutter spindle, transmits the movement of the tracer as it passed over the contours of the model to the cutter spindle—the reduction being proportionate to the setting of the pantograph bars. Work on curved surfaces is done through the use of a forming guide attached to the forming guide arm, which quickly swings out of the way when not in use. Samples of what 3-dimensional machines can do are shown in Fig. 9. These could also be hand engraved, but considerably more time would be needed. Master models are generally made of hard alloy brass, cast iron or bronze since they must withstand the pressure of the tracing point.

10



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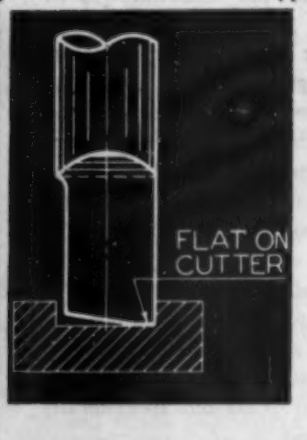

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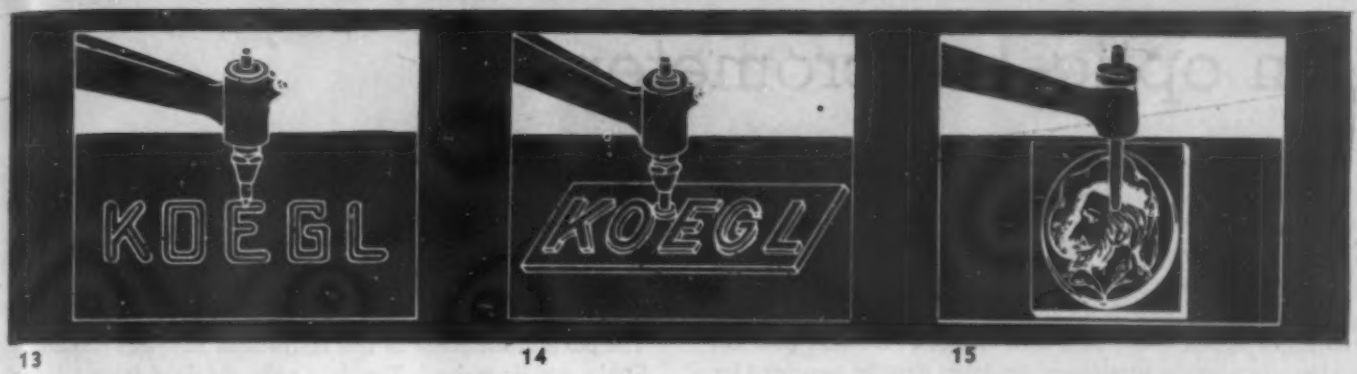
***8**—Forming guides, used in conjunction with the regular flat copy for curved work, are made of hardened tool steel and should have a curvature exactly opposite to that of the work being cut.* ***9**—Samples of the work done by 3-dimensional machines.* ***10**—The machining of irregular contours can be accomplished faster if direction of feed is upward.* ***11**—A smoother surface can be produced if a slight flat is stoned on the point of the cutting edge of a square-nosed single-flute cutter.* ***12**—When tapered slots are engraved, both a straight ground cutter and a tapered cutter should be used to produce the desired side taper*



13 14 15

13—A 90° cone-shaped tracing style is used with sunken V-groove copy. **14**—*A roller-tracer style, however, is generally used for cutting relief letters and designs or for cutting sunken letters and letters from square bottom groove copy.* **15**—*The third type of tracing style is round-nosed and is used for the engraving of three-dimensional work.* **16**—*Cavities or master hobs in which contour, size, shape and parting lines are continuously changing, are types of work best suited for hand engraving.* **17**—*Typical of hand engraved work are these lucky charms and novelty hobs.* **18**—*Hand engraving was used for the cutting of this hob for an Air Corps emblem.* **19**—*This hob is equally well adapted for hand engraving, machine engraving or engraving using a combination of both methods*

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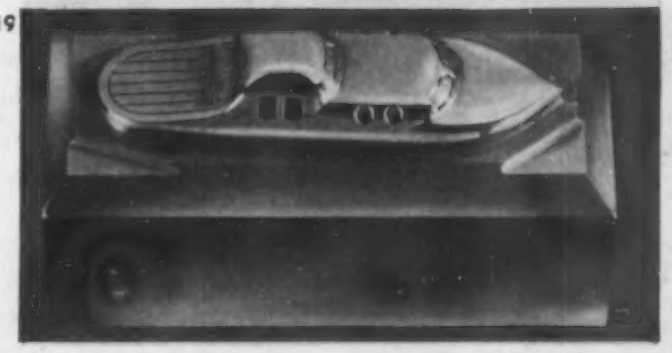


Machine cutter points

In machine engraving, the cutters are of paramount importance. Practically all are of the single-lip type although 3-, 4- or 6-in. sided cutters are sometimes used for such special work as side milling. An assortment of cutter points and cuts are shown in Fig. 7.

The cutters are generally made of high-speed steel, but when greater life is required tungsten-carbide tipped cutters should be used since they can be operated at higher speeds.

The importance of the correct grinding of these cutters cannot be stressed too strongly. Satisfactory work cannot be turned out if the cutters have been incorrectly ground.

In order to get a smooth finish, cutters are run at the highest possible speeds so as to remove the stock with several light fast cuts rather than with one heavy cut at a slower spindle speed. To help prevent the cutter from burning and losing its cutting edge a good cutting oil or mineral lard oil is often used. However, it is not always necessary to use a lubricant with small cutters.

Stoning a very slight flat on the point of the cutting edge of a square-nosed single-flute cutter (Fig. 11) will enable the cutter to produce a smoother finish, especially when it is cutting soft metals.

In 3-dimensional pantograph work in particular, the machining of irregular contours can be accomplished much faster if the direction of the feed is upward instead of down as illustrated in Fig. 10. For the engraving of tapered slots, the best results are obtained through the use of two separate types of cutters (Fig. 12). First a straight ground cutter should be used, then a tapered cutter to produce the desired taper on the sides.

Tracing styles

There are approximately three kinds of tracing styles used in following the copy or master templet. 1) For the cutting of sunken letters and designs, (*Please turn to page 192*)

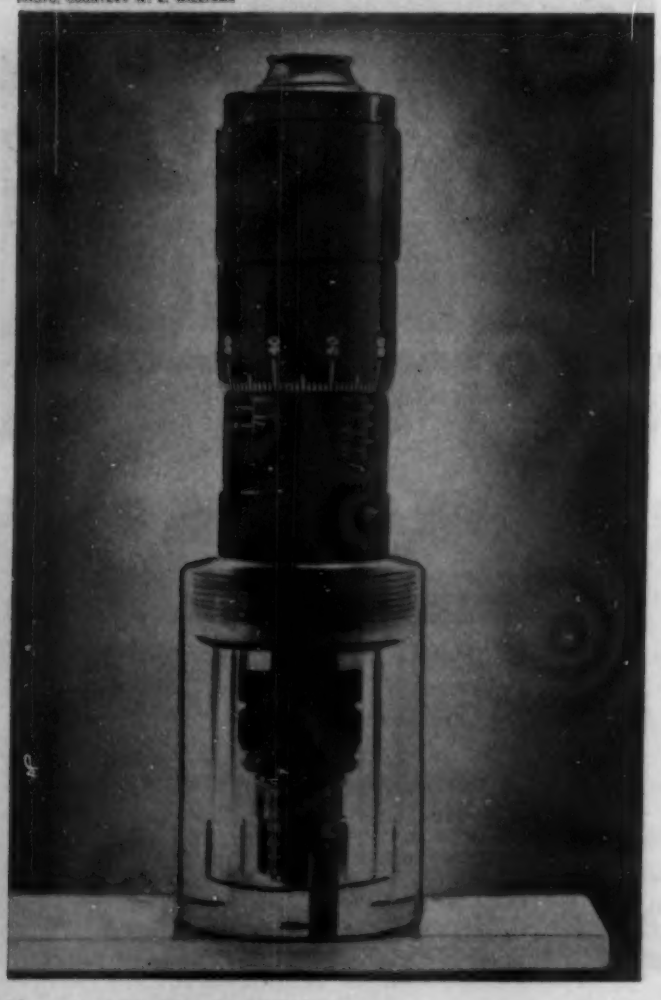
An optical micrometer

UNDER normal circumstances, measuring the thickness of a sheet of plastics offers no problem. Occasionally, however, the sheets to be measured are located in places where the ordinary micrometer cannot reach. Or the piece is so small that there is a danger of the optical surface being damaged by the usual measuring devices. Another problem arises when acrylic windows in airplanes must be measured for thickness. For these and similar cases, a new optical micrometer has been worked out on the principle of apparent depth.

Essentially, this instrument consists of a microscope which can be screwed up and down in an outer tube. The lower end of this tube is a plastic nosepiece that is held against the sheet to be measured (Fig. 1). The transparent sheet is marked with a crayon on the side away from the instrument and the measurement consists in sharply focussing this mark in the microscope. The readings on the barrel and thimble, just as in the case of an ordinary micrometer, give directly the thickness of the sheet. It takes just about the same time to obtain the reading with this new instrument as with the purely mechanical instrument.

1—Designed to measure the thickness of acrylic sheet this is located in out-of-the-way spots or is so small that the optical surface might be damaged by the usual measuring devices, this new optical micrometer operates on the principle of apparent depth. It has a nosepiece of plastic that is held against the sheet to be measured

PHOTO, COURTESY W. E. WILLIAMS



The number of turns per inch on the micrometer screw is $10\,N$, where N is the effective refractive index of the plastic for white light from a Mazda 15-watt daylight fluorescent lamp. The pitch of the screw of this instrument has been chosen to fit the acrylic resins. The data were obtained from a large number of observations on plates of different thickness. The scale is believed to be correct to within one-half of one percent, the limit being finally controlled by the accuracy of setting. The drum of the thimble is divided into 100 parts so that a single division on the scale represents 0.001 inch.

In the present instrument, two scales are provided: one scale reading from 0.0 to 0.4 in.; the other, from 0.4 to 1.5 inches. The second scale is operative when the front portion of the divisible 16-mm. objective is detached, thereby converting it into a 32-mm. objective.

The microscope can be focussed in either of two ways:

A) The instrument is adjusted until the image of the crayon mark has maximum clarity and sharpness.

B) The focussing is adjusted until there is no parallax between the image and the cross-wires in the eyepiece when the eye is moved from one side to the other.

Method *B* is the more accurate, but it takes a few seconds longer than Method *A*, which after a little practice becomes very reliable. The error of setting is inversely proportional to the square of the numerical aperture of the microscope. With the 16-mm. objective (using the 0.0- to 0.4-in. range) the error varies between 0.001 and 0.002 inch. With the 32-mm. objective the corresponding error of a single setting will lie between 0.004 and 0.008 inch. However, since the total thickness measured on this second scale is larger, the percentage accuracy will remain about the same, under one percent.

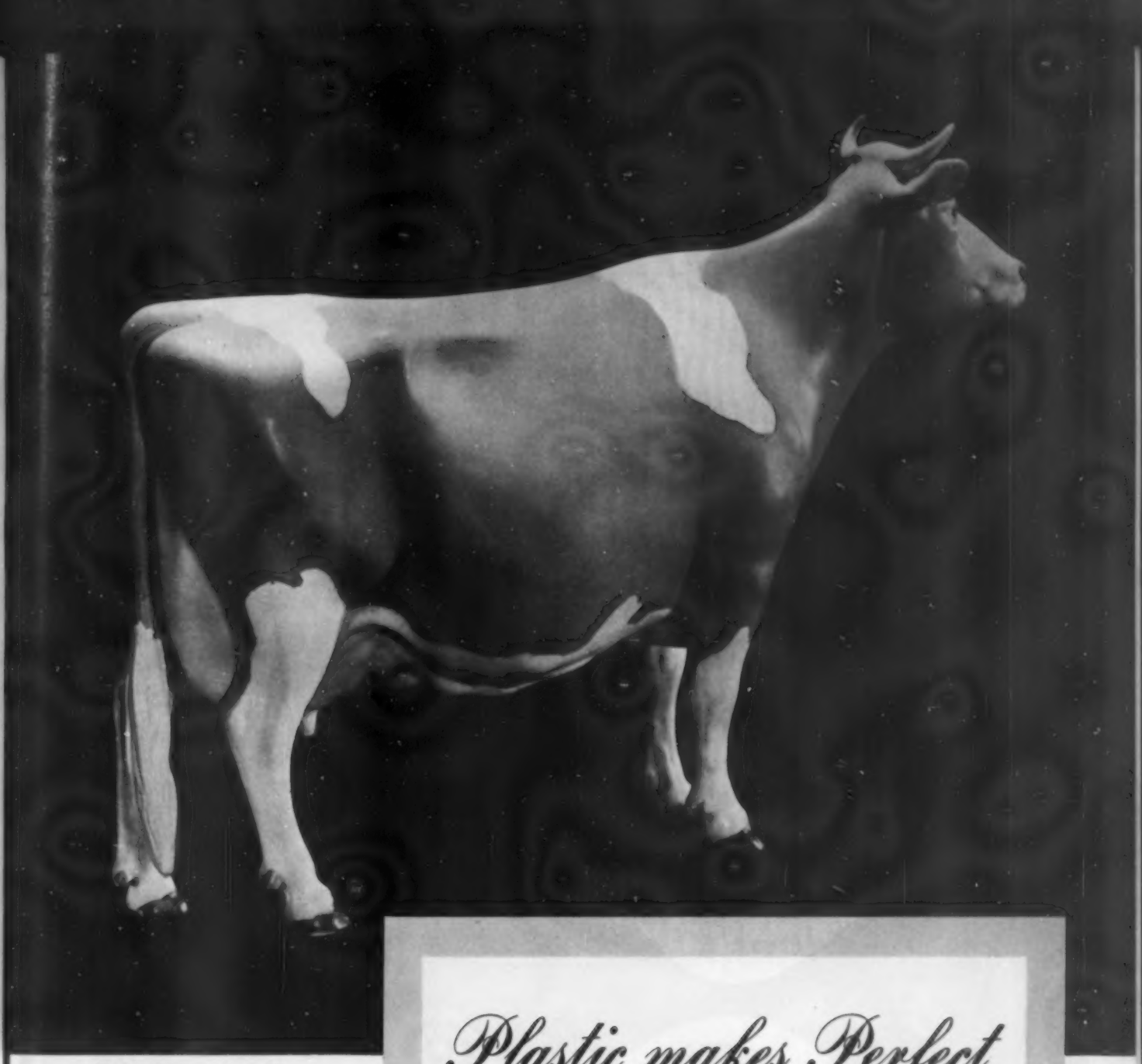
The acrylic nosepiece has three long inserts of very soft neoprene that project a few thousandths of an inch from the plane of the base. In use, these sink in, level with the plane of the base, and serve to prevent any lateral motion that might cause scratching. The steel screw fitted on the aluminum alloy microscope body has been hand lapped so that the inch diameter screw turns as easily as an ordinary micrometer.

After a little practice, there is no need for the observer to take zero readings for measurements on flat surfaces. He can rotate the thimble—setting the zero to suit his own vision—by loosening the Allen set screw with the key that is provided. A small brass disk insert beneath the set screw protects the microscope collar against damage.

When the work to be measured is curved, it is necessary to take readings on crayon marks on both sides of the sheet. The thickness is the difference between the readings. The error due to a sharp curvature in a cylindrical sheet is entirely eliminated by placing the crayon lines at right angles to the cylinder axis, i.e., placing the lines in the direction of steepest curvature. When this is done, the effective focussing of the sides of the lines is by rays in the meridian of low or zero curvature in the sheet.

The plastic nosepiece of this device is 2 in. in diameter and 3 in. long, the diameter of the thimble is 1.5 inches. The instrument weighs 1 lb. 3 oz.

Credits—Instrument produced by W. E. Williams.



nite cow molded by Elmer E. Mills Corp.
r Montgomery Ward & Co.

Plastic makes Perfect

This miniature cow molded of Tenite represents the ideal Guernsey. One-ninth life size and perfectly proportioned, the model was patterned after the best points of six cows of the "close to ideal" class, and will be used as a concrete basis for judging and the ultimate improvement of the breed.

The Tenite cow is composed of eight injection-molded pieces cemented together and painted. Tenite is molded to exact measurements, with faithful reproduction of the finest details, and has a high degree of dimensional stability. Because of the speed with which it can be molded, large-scale production is possible; a Tenite model of the ideal Guernsey can be made available to every buyer, breeder, and judge of cattle at a nominal price.

So enthusiastic has been the reception of the Tenite Guernsey that models are soon to be made of other breeds—Jersey, Holstein, Ayrshire, and Brown Swiss; Hereford, Shorthorn, and Aberdeen Angus. TENNESSEE EASTMAN CORPORATION (Subsidiary of Eastman Kodak Co.), KINGSPORT, TENN.

Tenite

AN EASTMAN PLASTIC

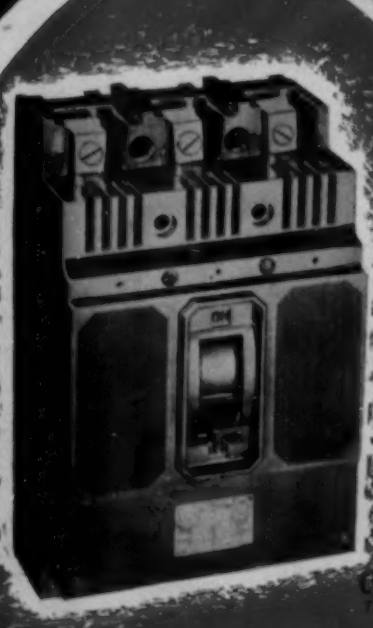
CLAREMONT FILLERS

The addition of Claremont Fillers to plastic formulations is prescribed where resistance to shock on the part of the finished product is desired.

To develop proper muscle for any given requirement, Claremont Fillers classify their strength-imparting factors into flock, fabric, thread, cord. Carefully graded, each type is uniform . . . clean . . . sinewy!

For the circuit breaker, illustrated, the use, for example, of Claremont chopped cotton fabric enabled the manufacturer to meet the specifications for shock resistance and extremely high flexural strength, without impairing the formula's resistance to arc and fire.

Samples of all four types of Claremont Fillers, together with laboratory assistance and technical data, are available upon request. Inquiries invited!



CLAREMONT WASTE MANUFACTURING CO. CLAREMONT
The Country's Largest Manufacturers of Flock NEW HAMPSHIRE

Photo, Courtesy
American Cyanamid Company

TECHNICAL SECTION

DR. GORDON M. KLINE, Technical Editor

Creep properties of molded phenolic plastics at elevated temperatures*

by W. J. GAILUS and DAVID TELFAIR**

MOLDED phenolic plastics have long been used in applications where stability at fairly high temperatures is of prime importance. Numerous studies have been made of the effects of different temperatures on such physical properties as tensile strength, flexural strength, compressive strength, shear strength, modulus, etc., with one exception: comparatively little has been done to increase our fund of information on the creep properties of thermosetting materials. The papers which have been published on this subject cover only a small range of stress values and are on tests of fairly short duration. Practically no data are in existence at the present time on the creep of phenolic materials at high temperatures.

The work described herein was undertaken to complement the investigation previously reported by Telfair, Nason and Carswell[1] and to obtain a more definite understanding of the behavior of phenolics at high temperatures. The research was concerned with the creep behavior of molded phenolic plastics at approximately 192° F. Tension creep data up to 1000 hours are reported, and recovery data up to 250 hours is indicated.

Values of modulus of elasticity were obtained at the beginning and also at the end of the 1000-hr. tests. The effect of moisture on the creep properties of the various materials was likewise studied.

The materials investigated included molded phenolics with woodflour, chopped canvas (rag), cotton cord, asbestos and mica fillers, unfilled phenolic resin and two types of paper laminate (both cross-laminated). The filled materials contained approximately 50 percent phenol-formaldehyde resin and 50 percent filler with the exception of the asbestos-filled material which contained approximately 40 percent resin, 45

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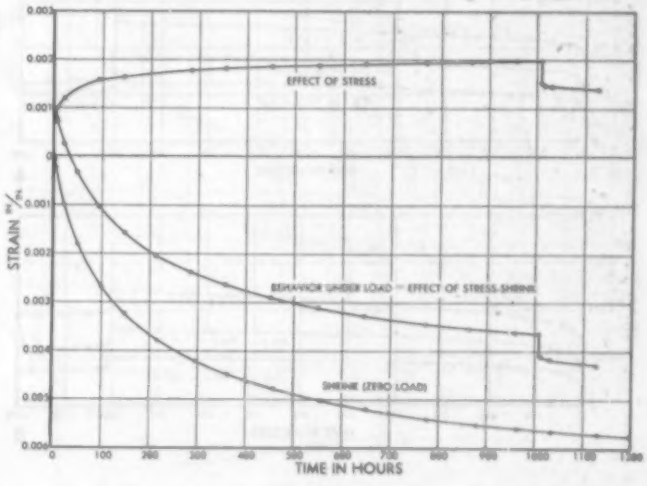

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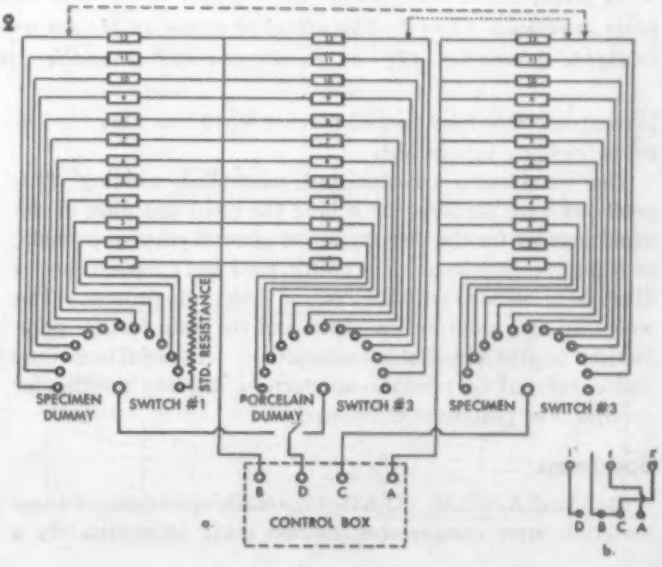
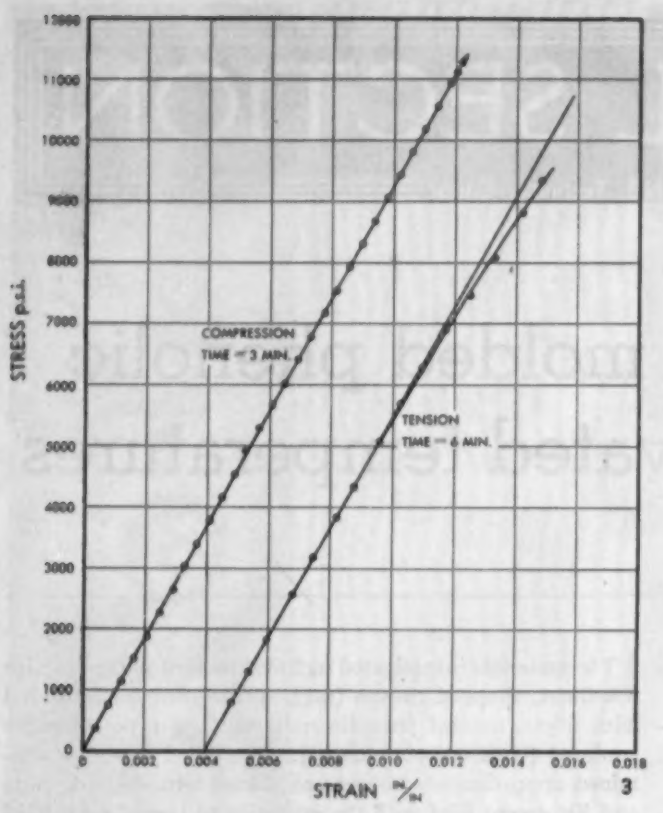


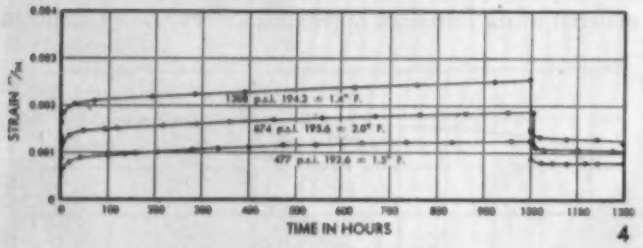
* Presented before the Rubber and Plastics Division at the Annual Meeting of the American Society of Mechanical Engineers, New York, N. Y., November 30, 1944, and published on these pages through the courtesy of that Society.

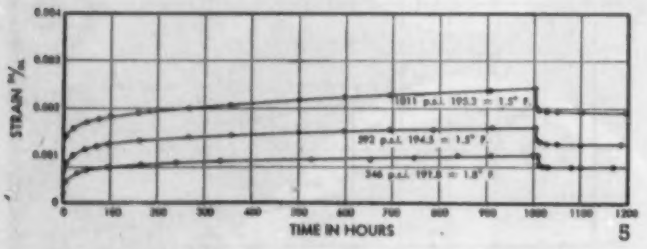
** Research Department, Plastics Div., Monsanto Chemical Co.

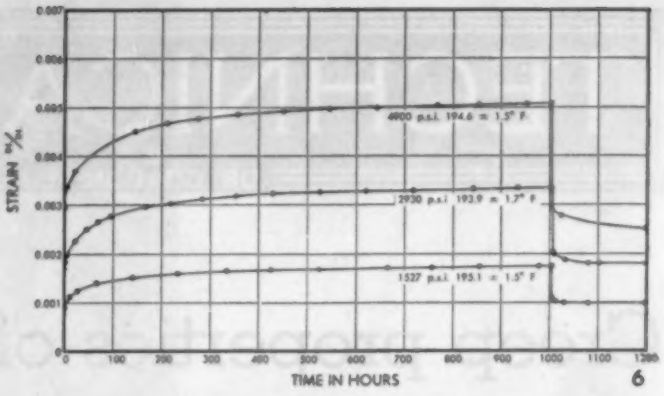
[1] David Telfair, T. S. Carswell and H. K. Nason, "Creep Properties of Molded Phenolic Plastics," MODERN PLASTICS *21*, 137 (Feb. 1944).

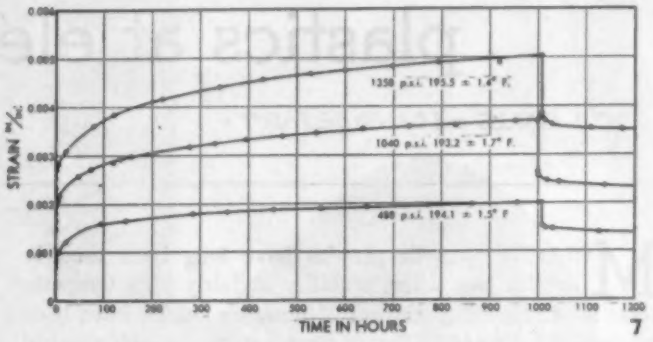
1—The chart shown here, which graphically portrays the effects of stress, shrink and behavior under load (effect of stress-shrink) on a woodflour-filled phenolic at 488 p.s.i., 194.1 ± 1.4° F., serves to illustrate the use of these terms as they are applied to the various materials which are discussed throughout the text. 2—A circuit diagram which is used in the study of creep phenomena at 192° F. In the switching arrangement, (a) indicates a specimen versus a specimen or a "standard" porcelain dummy, and (b), indicates a porcelain versus a specimen dummy. The stability of the porcelain dummies was checked periodically against a standard resistance

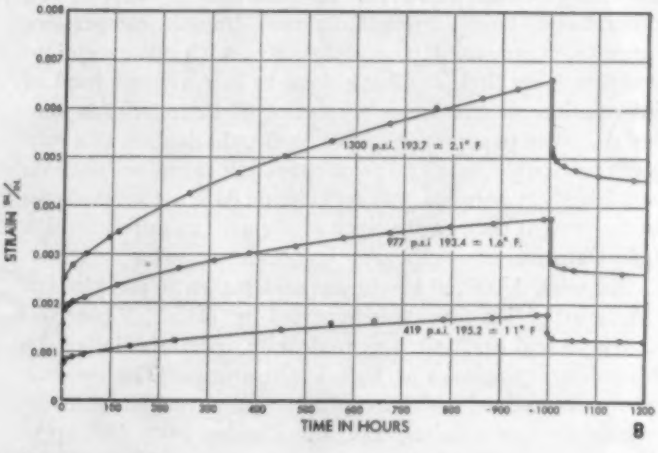


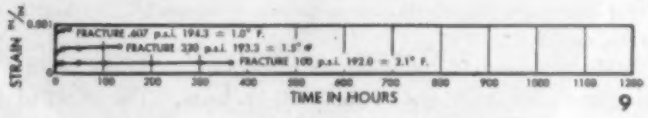












3—A stress-strain diagram of SR-4 gages calibrated in tension and compression when mounted on a pure phenolic-resin specimen. 4 to 9—The effect of stress on (4), an asbestos-filled phenolic; (5), a mica-filled phenolic; (6), a paper-laminate phenolic; (7), a woodflour-filled phenolic; (8), a rag-filled phenolic; (9), an unfilled phenolic resin

percent asbestos filler and 15 percent woodflour filler (to improve molding properties).

The woodflour-, asbestos and mica-filled molding compositions were prepared by rolling the resin and filler in the usual manner for the preparation of general-purpose phenolic molding compositions. The cotton cord and chopped canvas fillers were blended with the resin in a wet mix process. The wet resin-filler mixture was dried and the resin further polymerized to give a moldable composition. A special technique was developed to produce satisfactory molding powder for specimens of pure resin compound.

Specimens

Standard A.S.T.M. (D 638–42) tensile specimens of these materials were compression molded using approximately a 10-min. cure at 165° C. and a pressure on the specimen of approximately 4000 pounds per square inch. The specimens were cooled to below 85° C. before removal of pressure. The paper laminate specimens were machined from sheets supplied by Forest Products Laboratory of high-strength paper, cross-laminated, using two phenolic resins.

SR-4 strain gages were mounted with phenolic cement on opposite sides of each specimen. "Dummy" specimens, for use as the balancing arm in the Wheatstone's bridge circuit, were made up in the same way, and "standard" dummies were made by mounting SR-4 gages on unglazed porcelain.

Definitions

The terms *elastic deformation*, *creep* or *delayed deformation*, *elastic recovery*, *delayed recovery* and *permanent set* have been

defined and illustrated in the preceding paper.[1] Figure 1 illustrates the meaning of the additional terms *shrink*, *effect of stress* and *behavior* as they will be used in this paper.

Testing equipment and procedure

A special technique was developed to study the creep phenomena at 192° F. The electrical measuring system used is shown as a circuit diagram in Fig. 2. More detail concerning the testing equipment may be found in the earlier paper.[1]

With this setup it was possible, first, to obtain *effect of stress* data—all effects of thermochemical reaction within the specimen were automatically cancelled out by balancing a virgin specimen against a virgin specimen dummy (assuming, of course, that the thermochemical reaction within the specimen is the same without stress as it is with stress). Second, *behavior* data—a measure of the absolute deformation under the conditions imposed—were obtained by balancing a specimen against a "standard" porcelain dummy. Third, *shrink* data (zero load) were obtained by balancing a porcelain dummy against a specimen dummy. The stability of the porcelain dummies was checked periodically against a standard resistance (Fig. 2). In order to increase the accuracy of the measurements, slight changes were made in the SR-4 control box circuit so that it would operate as an adaptation of the Kelvin bridge, in effect reducing to a minimum errors caused by switch resistances.

Constant longitudinal loads were applied, as before, in the form of lead weights in convenient increments. The loads applied to each material varied from zero to values which caused fracture in less than 1000 hours. Results are reported only for specimens that stood up for 1000 hr., except in the case of unfilled resin. Strain readings were taken for each load increment and the results were used for obtaining modulus data. The extension due to the application of the load was measured as a function of time over a period of 1000 hours. The loads were then removed in increments and strain readings were again taken. The contraction due to removal of load was then measured as a function of recovery

10 to 15—*The behavior under load of (10), an asbestos-filled phenolic; (11), a mica-filled phenolic; (12), a high-strength paper laminate; (13) woodflour-filled phenolic; (14) rag-filled phenolic; (16), unfilled phenolic resin*

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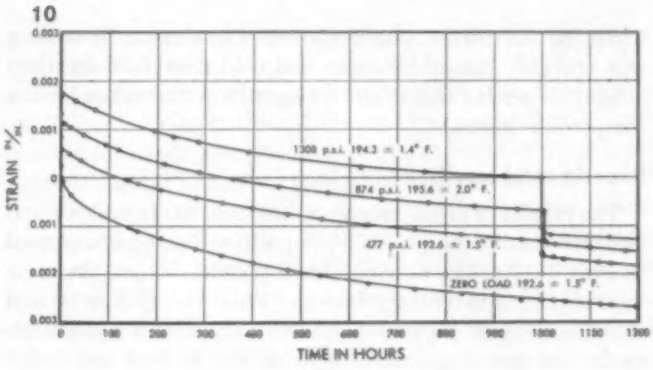

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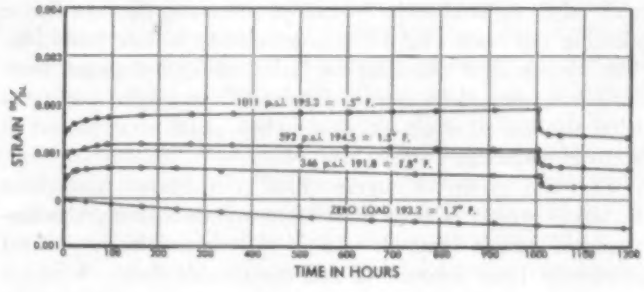

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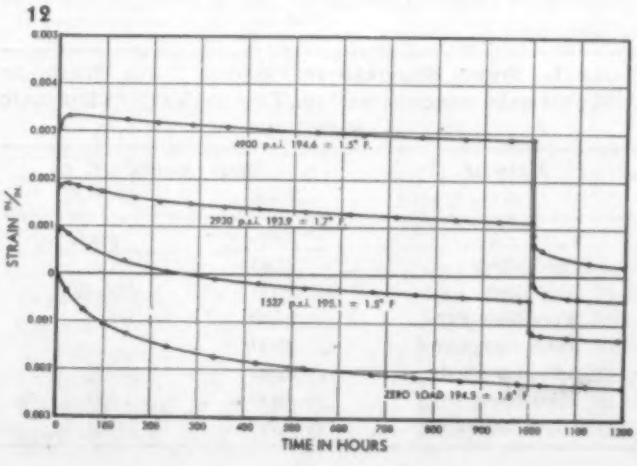

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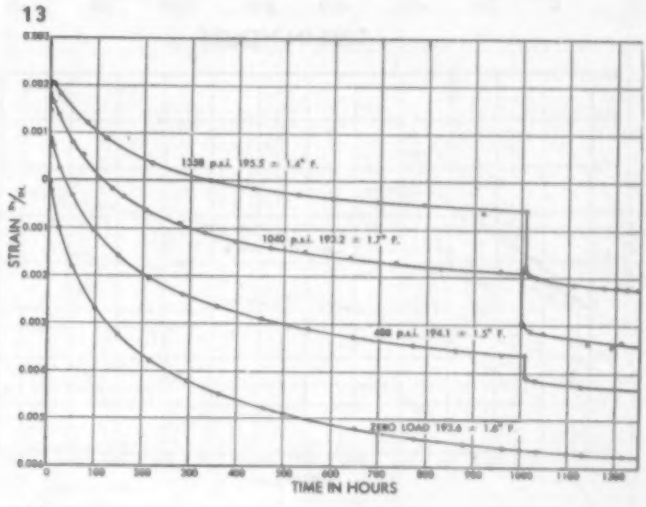

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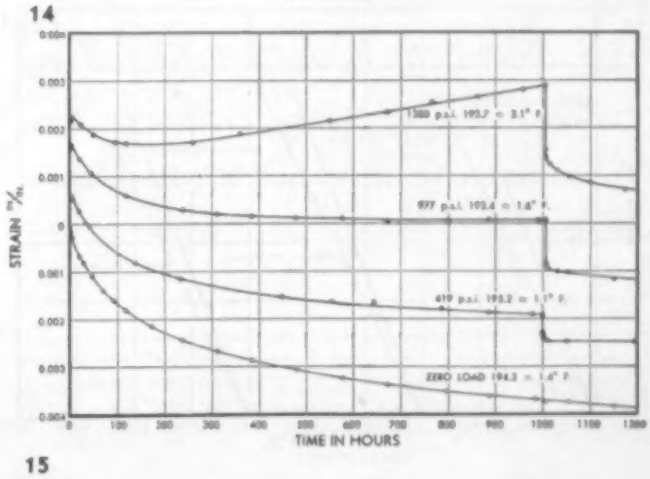

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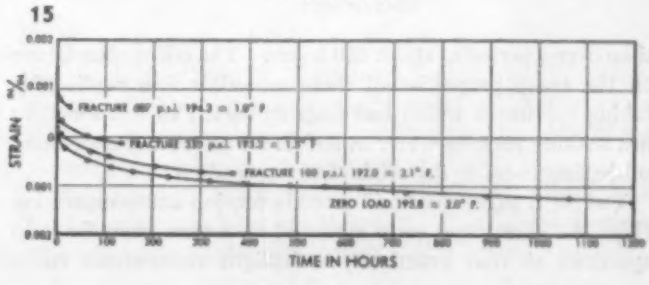
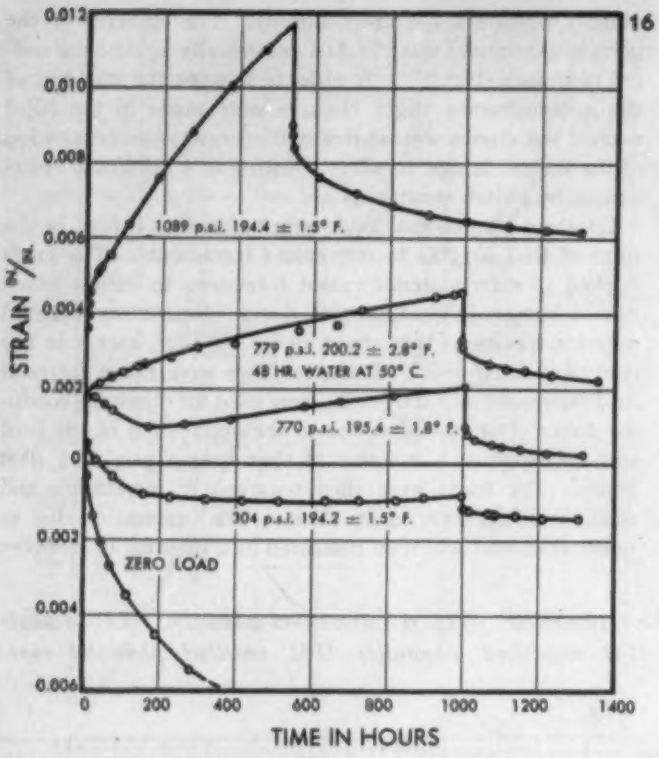
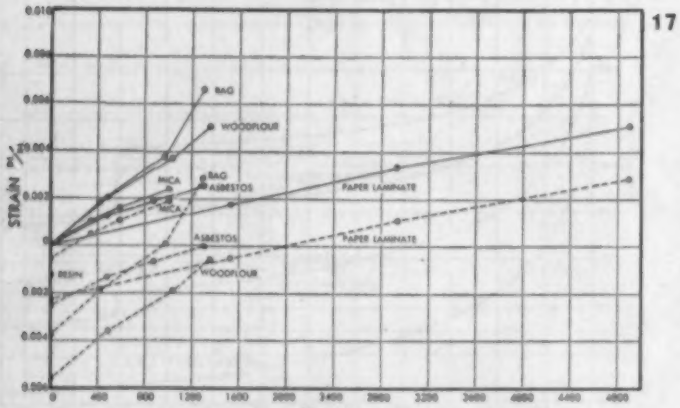
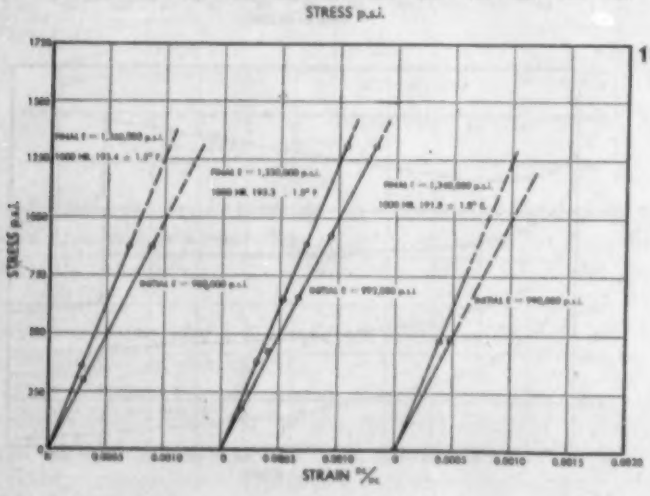
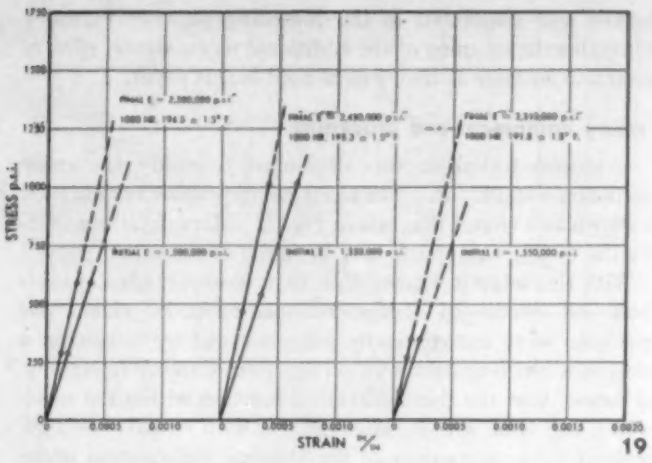










16—*Behavior under load of tire-cord-filled phenolic.* **17**—*Total creep after 1000 hr., 192 ±°F. Solid lines indicate effect of stress; broken lines, behavior.* **18**—*Stress-strain diagram of asbestos-filled phenolic under continued heating.* **19**—*Stress-strain chart of mica-filled phenolic showing effect of continued heating on modulus*

time over a period of about 250 hours. The effect of moisture on the creep properties of these materials was studied by taking specimens which had been subjected to test for 1250 hr., soaking them in water at 50° C. for 48 hr. and once more subjecting them to the original test procedure.

The SR-4 gages were calibrated in tension and compression (Fig. 3). The gages were mounted on a pure phenolic resin specimen so that practically a straight stress-strain curve would be obtained. The deviation of the curve in tension was probably caused by creep and cold flow since the time interval of testing was so much longer than that taken for the compression curve.

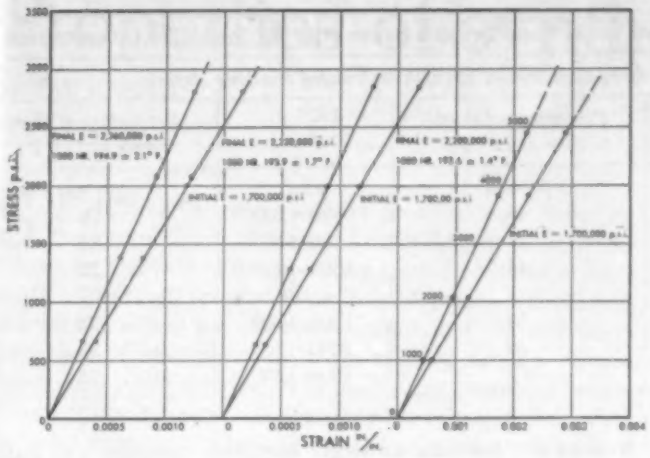
Experimental results

The results of creep measurements for the six molded and two cross-laminated phenolic compositions have been plotted in Figs. 4–17. These materials, in general, possess the same type of creep and recovery curves. From Fig. 1 it can be seen that the creep at high temperatures consists of a balance between the opposing actions of strain due to load and shrink due to molecular transformation. The technique used in this work permitted a separation of these components so that each might be studied individually. Rectangular coordinate plotting has been used to enhance clarity of interpretation. The *shrink* data obtained by using the SR-4 gages were further confirmed by results obtained from virgin specimens with mechanical strain gages attached which were placed in an oven maintained at 192° F.

The first group of curves (Figs. 4–9) shows how these materials would behave under stress action alone, thermochemical effects ignored. All of the materials showed an extremely large amount of non-recoverable flow. A rough comparison of the stress required to produce a total strain (elastic plus inelastic) of 0.003 in. per in. during a 1000-hour

TABLE I.—STRESS REQUIRED TO PRODUCE TOTAL STRAIN OF 0.003 IN. PER IN. DURING A 1000-HR. TEST FOR VARIOUS PHENOLIC COMPOSITIONS

Material	*Stress required at:*	
	77° F.	*192° F.*
	p.s.i.	*p.s.i.*
Cord-filled	2150	...
Rag-filled	2100	700–800
Woodflour-filled	2400	800
Resin compound	2100	...
Asbestos-filled	2700	1600
Mica-filled	4800	1400
Paper laminate	...	2600



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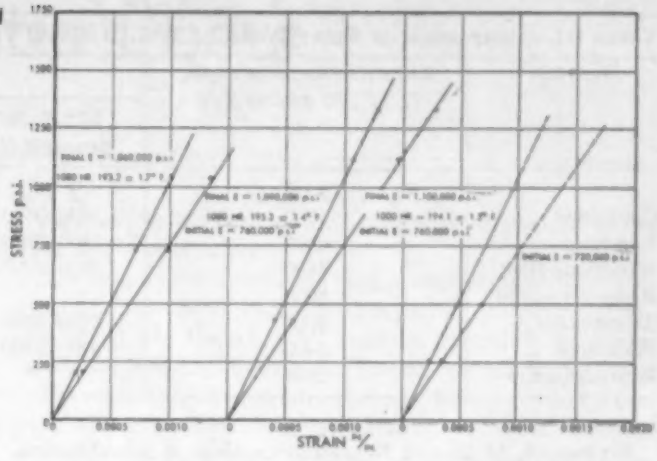

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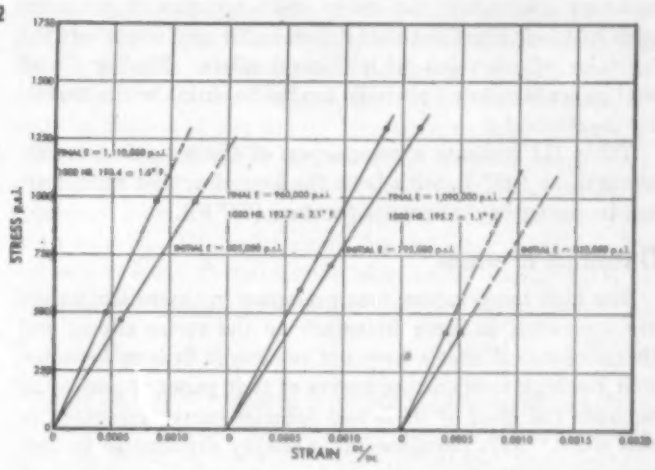

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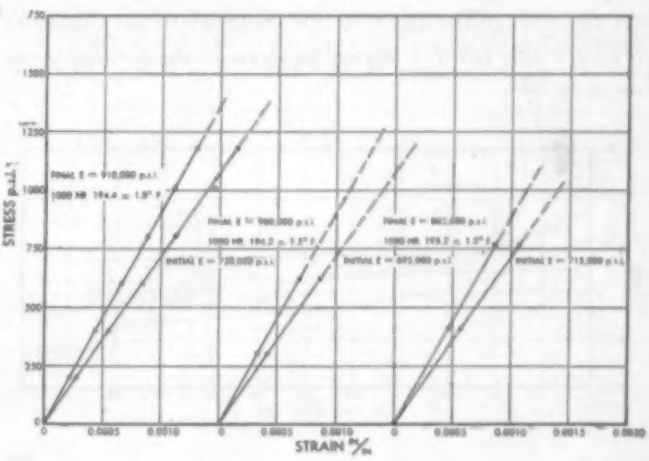

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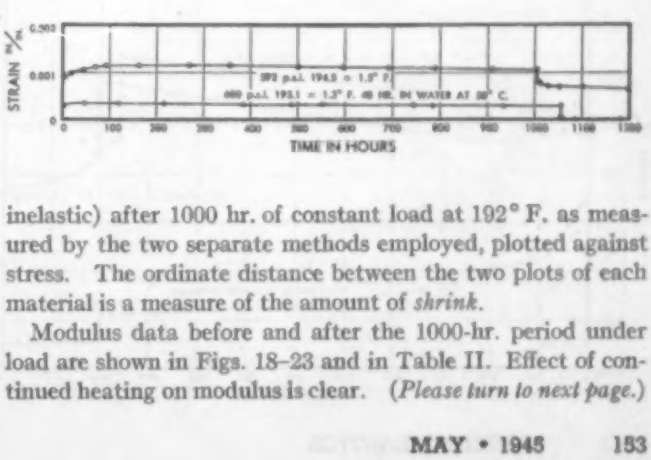

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***20** to **23**—A series of stress-strain diagrams showing the effect of continued heating on the modulus of (20), a paper laminate phenolic; (21), a woodflour filled phenolic; (22), a rag filled phenolic; and (23), a tire cord filled phenolic. **24**—The effect of moisture on the behavior of a mica filled phenolic is shown*

test at 192° F. as against room temperature (77° F.) is presented in Table I.

The unfilled resin compound would not bear a stress as low as 100 p.s.i. for more than 370 hr. at this temperature. Only one set of data is presented for the paper laminate since both materials proved to have identical creep characteristics.

The second group of curves (Figs. 10–16) shows the actual *behavior* of the materials—a summation of the physical and thermochemical forces acting on the specimens. A survey of the data plotted for zero stress gives a picture of the effects of thermochemical reaction within the specimen: it compares the materials on the basis of *shrink*.

Mica-filled phenolic, unfilled resin compound, paper laminate, asbestos-filled phenolic, rag-filled phenolic, woodflour-filled phenolic, and tire-cord-filled phenolic array themselves in that order when compared on this basis—mica shrinking least and tire cord most. It is only reasonable that the temperature employed throughout this investigation would show little effect on such a heat-insensitive filler as mica while it is well known that cellulosic materials shrink considerably when subjected to heat.[2–4] The somewhat strange behavior of the asbestos-filled phenolic is explained by the fact that 15 percent of the "asbestos"-filled molding powder was woodflour.

Figure 17 shows the average total deformation (elastic plus inelastic) after 1000 hr. of constant load at 192° F. as measured by the two separate methods employed, plotted against stress. The ordinate distance between the two plots of each material is a measure of the amount of *shrink*.

Modulus data before and after the 1000-hr. period under load are shown in Figs. 18–23 and in Table II. Effect of continued heating on modulus is clear. (*Please turn to next page.*)

[2] W. F. Busse, E. T. Lessig, D. L. Longhborrough and L. Larrick, "Fatigue of Fabrics," J. Applied Mechanics *13* (Nov. 1942).
[3] J. Delmonte, "Permanence of the Physical Properties of Plastics," MODERN PLASTICS *17*, 65 (June 1940).
[4] H. Leaderman, "Elastic and Creep Properties of Filamentous Materials," Textile Foundation, Washington, D. C. (1943).

TABLE II.—MODULUS DATA AT 192° F. FOR VARIOUS PHENOLIC COMPOSITIONS

Material	*Average modulus of elasticity*		*Increase*
	At beginning of test	*After 1000 hr. under load*	
	p.s.i.	*p.s.i.*	*percent*
Tire-cord filled	710,000	898 000	26.5
Rag-filled	807,000	1,053,000	30.5
Mica-filled	1,760,000	2,347,000	50.4
Asbestos-filled	987,000	1,243,000	25.9
Woodflour-filled	746,000	1,083,000	45.0
Paper laminate	1,700,000	2,227,000	31.0

TABLE III.—COMPARISON OF SHORT-TIME (A.S.T.M. D 638–42 T) AND LONG-TIME TENSILE STRENGTHS OF PHENOLIC COMPOSITIONS

Material	*Short-time tensile strength, 77° F., 50 percent R.H.*	*Long-time tensile strength (estimated limiting stress)*			
		77° F., 50 percent R.H.	*Percentage of short-time at 77° F.*	*192° F.*	*Percentage of short-time at 77° F.*
	p.s.i.	*p.s.i.*	*percent*	*p.s.i.*	*percent*
Cord-filled	6000	2400–2800	43	900–1200	18
Rag-filled	6100	2400–2800	43	1200–1400	21
Woodflour-filled	6100	2600–2800	44	1300–1400	22
Resin compound	8900	...	...	< 100	...
Asbestos-filled	5700	2800–3200	53	1300–1400	24
Mica-filled	5400	2200–2400	39	1200–1500	25
Paper laminate	2800	...	...	4900–5200	18

Figures 15, 24, 25 and 26 present the data obtained from a study of moisture effects. The curves tend to show that moisture does affect the creep characteristics of phenolics with *cellulosic* fillers but that it does not in any way affect the behavior of phenolics with mineral fillers. Findley found that paper-laminated phenolic tended to shrink when humidity decreased.[8]

Table III presents a comparison of the long-time tensile strength at 192° F. with both the long-time and short-time tensile strengths at room temperature (77° F.).

Discussion of results

The high temperature data presented in the earlier paper[1] are somewhat in error inasmuch as the stress effects and thermochemical effects were not resolved. It is to be noted that the high temperature curves of that paper appear to lie between the *effect of stress* and *behavior* curves presented in this work. This phenomenon is readily explainable in that the same specimen dummies had been *repeatedly* used in those tests and had already "shrunk" to varying degrees in the first run. In succeeding tests the dummies would therefore tend to act partially as virgin specimen dummies and partially as porcelain dummies.

The change in properties of phenolics after being exposed to heat is presumably connected with a continuation of the condensation reaction. It is well known that in the curing of thermosetting resins, as in other chemical processes, the reaction of the constituents is practically never complete. The specimens used in this work were molded at a temperature of 165° C. with a cure time of about 10 minutes. As a general rule, a chemical reaction doubles in speed for each 10° C. rise in temperature. Thus, while the reaction during molding proceeded about 181 times as fast (estimated) as it did at the testing temperature (90° C.), the total time of molding was only one six-thousandth of the time the specimens were subjected to test. It is only reasonable to presume that the materials continued to cure slowly during the tests.

Data taken on phenolic resin before and after molding showed that specific gravity changed about one percent. The shrink observed for phenolic resin during the creep test was 0.00123 in./in., which corresponds to a density increase of 0.369 percent. If this shrinkage were entirely due to continued condensation, this (*Please turn to page 192*)

[8] W. N. Findley and W. J. Worley, "Short Time Static Tests and Creep Tests of a Paper Laminated Plastic," 47th Annual Meeting A.S.T.M., June 26–30, 1944.

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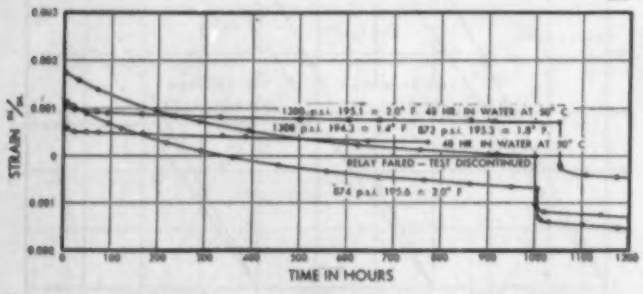

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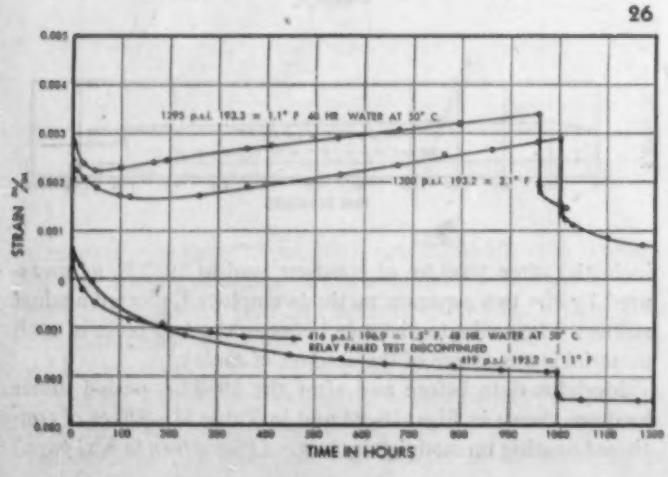

25 *and* **26**—*Effect of moisture on behavior of (25), asbestos-filled phenolic; (26), rag-filled phenolic.* **27**—*Plot of creep rate percent per 1000 hours versus stress*

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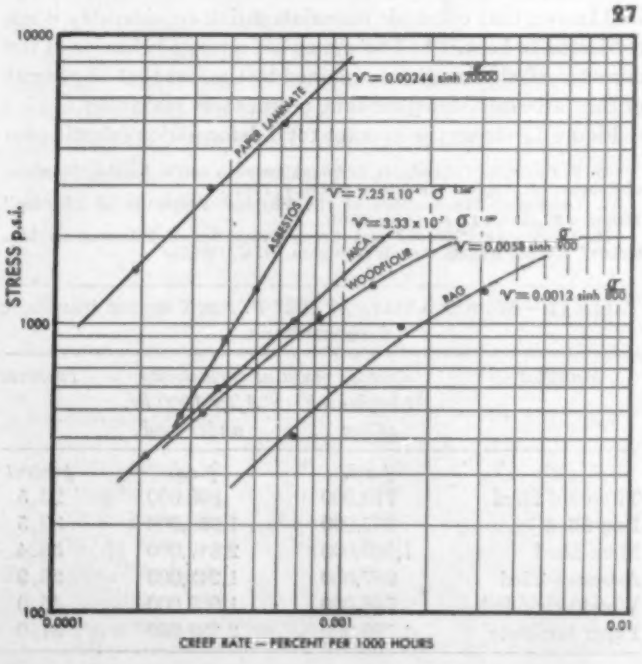


Properties of synthetic fibers*

by WM. D. APPEL**

SCIENCE and engineering have provided new fibers for the manufacture of textiles as startling in their possibilities for this field of use as are the related plastics for other fields. The rapid progress in their development immediately preceding the war has been accelerated, and the new fibers have been utilized effectively by the military services. These fibers, and others to come, hold fascinating prospects for the future of the industry. Indeed they are releasing the textile industry from the limitations imposed by the exclusive use of natural fibers.[1]

But it is not the purpose of this paper to eulogize these new developments and extol the merits of particular products, or to describe the current uses and future possibilities of the synthetic fibers. Others have done that.[1, 2] The object is to summarize available data on the important properties of the fibers and compare them with similar data for cotton, wool and silk.

This would appear easy in view of the excellent summary of synthetic fiber properties by Woolf and Chase,[2] and the data in the numerous technical articles on these fibers.[3] Since textile chemists and colorists are more concerned with the chemical and physical behavior of the fibers than with the glamour that surrounds them in advertising, an assessment of these fibers on the basis of their properties as revealed in the data should be of interest.

The data on the fibers have been assembled from the viewpoint of their use as engineering materials—a viewpoint expressed by Dr. Harold deW. Smith in his Marburg lecture before the American Society for Testing Materials last June.[4]

The results are disappointing because technical information is meager even for the natural fibers. Excellent data are available for particular properties of particular fibers, but comparable data for others are lacking. One must realize, of course, that much of the work to date has been exploratory in nature. The difficulties involved in testing textile fibers, the lack of suitable test methods for some properties, and the dependence of the results upon the condition of the material and the method of test should constantly be kept in mind.

This is a fertile field for research. There is need for a systematic comparative study of the properties of the fibers conducted in a single laboratory with well-defined materials and methods. Dr. Smith expressed the hope that this work will begin soon. Perhaps something can be done about it at the National Bureau of Standards when the war is over.

Composition and structure

Table I has been prepared to emphasize the chemical nature of the fibers; the structural units from which the fibers are built are shown at the right of the group and trade names. These units are linked end to end in the fiber, forming mole-

* Presented at the Annual Meeting of the American Association of Textile Chemists and Colorists, Atlantic City, N. J., Oct. 14, 1944, and published here through the courtesy of the American Dyestuff Reporter.

** National Bureau of Standards. Miss Josephine M. Blandford gathered the data and prepared the tables for this paper. Her help is gratefully acknowledged.

[1] "The Case for Synthetic Textiles," MODERN PLASTICS, *22*, 91 (Sept. 1944).

[2] "Synthetic Fibers for the Postwar World," by Douglas G. Woolf and Winn W. Chase. Textile World *9*, 93 (Sept. 1943).

[3] See annual lists of articles on synthetic fibers in the Yearbooks of the American Association of Textile Chemists and Colorists.

[4] "Textile Fibers, an Engineering Approach to Their Properties and Utilization," by Harold DeWitt Smith. Edgar Marburg Lecture. Presented before the 47th Annual Meeting of the American Society for Testing Materials. To be published by the A.S.T.M.

TABLE I — COMPOSITION AND STRUCTURE OF FIBERS

CELLULOSIC FIBERS

COTTON AND RAYON (EXCEPT ACETATE) R = H

ACETATE RAYON R = $-C-CH_3$ (O)

PROTEIN FIBERS

SILK, WOOL, CASEIN (ARALAC), SOYBEAN — R = PRINCIPALLY $-CH_3$; R MAY BE ONE OF MANY SUBSTITUENTS SUCH AS $-CH_2-CH_2-COOH$, $-CH_2-CH_2-CH_2-CH_2-NH_2$, $-CH_2-S-S-CH_2-$

POLYAMIDE (NYLON) IN ONE TYPE, X = 4, Y = 6

VINYL RESIN (VINYON) 88-90 % / 12-10 %

VINYLIDENE CHLORIDE (SARAN, VELON, PERMALON)

GLASS (FIBERGLAS) • = SI, ○ = O, ● = NA, CA, ETC.

This table, which shows both the composition and the structure of fibers, emphasizes their chemical nature. The structural units from which they are built are shown at the right of the group and trade names

TABLE I— DIMENSIONS AND CONFIGURATION OF FIBERS

FIBER	LENGTH CONTINUOUS	LENGTH STAPLE	WIDTH MICRONS	CROSS SECTION	SPECIAL FEATURES
GLASS	YES	YES	8 TO 16		
POLYAMIDE (NYLON)	YES	YES	18 TO 24,UP		
PROTEIN (CASEIN, SOYBEAN)	NO	1/2 TO 8 IN	15 TO 27		CRIMPED
RAYON (INCLUDING ACETATE, FORTISAN)	YES	YES	11 TO 46		SOMETIMES CRIMPED
VINYLIDENE CHLORIDE (SARAN, VELON, PERMALON)	YES	NOT AT PRESENT			
VINYL RESIN (VINYON)	YES	NOT AT PRESENT	18 TO 18		
SILK	400 TO 600 YARDS	YES	9 TO 11		
WOOL	NO	1.5 TO 15 IN	18 TO 41		SCALES, CRIMPED
COTTON	NO	USUALLY LESS THAN 1.5 INCHES	16 TO 20		CONVOLUTED

The present status of commercial fibers with respect to such characteristics as length, width, cross sections and special features, is shown here. The cross sections are merely suggestions rather than actual reproductions of the materials tabulated

cules several hundred to several thousand units long. The orientation of these linear polymeric molecules lengthwise of the fiber—by nature as in cotton or by stretching, drawing or other special handling as in the manufacture of certain types of rayon, polyamide, vinyl resin and vinylidene chloride fibers—leads to increased crystallinity of structure and increased strength. Cross linkages between the long-chain molecules of wool give this fiber an elastic net-like structure.

Many of the properties of the fibers besides those of strength and elasticity, are inherent in the composition and structure of the fibers. For example, the hygroscopicity of the cellulosic fibers is associated with the OH groups in the formulation, while the absence of this same property in vinyl resin and vinylidene chloride fibers is closely related to the absence of these groups. The stability and the dyeing characteristics of the fibers depend primarily upon the chemical structure. Thus, the absence of OH, COOH and NH groups from vinyl and vinylidene chloride fibers accounts for their lack of affinity for dyes and for their resistance to acids, alkalis, mildew and bacteria.

The structural formulas suggest many ways in which the fibers, both natural and synthetic, can be modified by chemical means to improve their performance. Cotton itself can be modified through substitution at its OH groups. Acetate rayon, which is nominally cellulose diacetate, is only one of several derivatives of cellulose of commercial importance. Other esters and ethers have been made into fibers. Deacetylation of acetate rayon under suitable conditions gives Fortisan, one of the strongest synthetic fibers available today.

By splitting and blocking the —S—S— linkages in wool,

TABLE III.—TENSILE STRENGTH OF FIBERS

Fiber	*Dry*	*Wet*
	Grams per denier	*Percent of dry*
Polyamide, strong	7.0–6.0	90– 84
Rayon, saponified acetate	7.0–4.8	88– 65
Glass	6.5–3.3	97
Cotton, Sea Island	6.3–4.4	130–110
Vinylidene	6.0–3.6	100
Cotton, American Egyptian, American Upland	5.5–4.2	130–110
	4.9–3.0	130–110
Silk, degummed	4.9–2.8	95– 75
Polyamide, regular	4.8–4.5	90– 84
Rayon, viscose, strong	4.6–3.4	86– 45
Vinyl, strong	4.4–3.5	100
Rayon, viscose, semi-strong	2.9–2.5	62
Vinyl, regular	2.4–2.0	100
Rayon, viscose, regular	2.4–1.8	54– 44
cuprammonium	2.3–1.6	55
Rayon, acetate	1.8–1.2	70– 56
Wool	1.7–1.0	97– 76
Casein	1.0–0.6	50– 35
Soybean	0.6	30
Vinyl, elastic	0.2–0.1	100

TABLE IV.—EXTENSIBILITY OF FIBERS

Fiber	*Elongation at break* *Dry*	*Wet*
	Percent	*Percent*
Vinyl, elastic	400	400
Wool	50–28	61–29
Casein	50– 7	120–83
Soybean	40	60
Vinyl, regular	35–14	35–14
Rayon, acetate	30–23	38–30
Vinylidene	30–20	30–20
Polyamide, regular	22–18	30–12
Silk	20–13	
Rayon, viscose, regular	20–16	35–18
viscose, semi-strong	20–16	27–20
viscose, strong	19– 9	22–14
cuprammonium	17–10	33–17
Polyamide, strong	17–11	30–12
Vinyl, strong	16	16
Cotton	7– 3	
Rayon, saponified acetate	6	6
Glass	3– 2	2– 1

the Textile Foundation laboratories at the National Bureau of Standards have been able to make wool indigestible by moth larvae and resistant to alkaline laundering. Many types of polyamide fibers with differing properties can be produced through choice of the raw materials used in their manufacture and by a variation in the degree of polymerization. Ten types are said to be in production. By varying the proportions of vinyl chloride and vinyl acetate in vinyl resin fibers, the properties of the product can be adapted to meet the needs of particular uses. The same can be said for vinylidene-chloride fibers. Several types of glass fibers are produced.

These facts are reviewed to emphasize this phase of the adaptability of the fibers. Synthetic fibers can be produced in a great variety of chemical types from a few raw materials just as can aniline dyes. To a lesser degree natural fibers can be modified to meet special requirements of use.

TABLE V.—RECOVERY ON UNLOADING OF FIBERS

Fiber	*Elongated*	*Recovery*	*Time*
	Percent	*Percent*	*Seconds*
Glass	..	100	..
Polyamide	1	82[a]	60
	2	63[a]	60
	4	73	60
	8	100	60
	16	91	60
Vinyl, acetate	..	96	After a time
	Up to 80	90	Immediately
Vinylidene	..	95	..
Silk	1	82[a]	60
	2	74[a]	60
	4	76	60
	4	59[a]	60
	8	56	60
	16	47	60
Aralac	..	Less than wool	..
Rayon, viscose, regular	4	74–30	..
	14	58	..
Rayon, acetate	4	65–50	..
	14	29	..

[a] Against a load of 0.25 gram per denier.

TABLE VI.—MODULUS OF ELASTICITY OF FIBERS

Fiber	*Static method*	*Dynamic method*	*Velocity of sound method*
	10^{10} dynes /sq. cm.	*10^{10} dynes /sq. cm.*	*10^{10} dynes /sq. cm.*
Quartz	..	..	128–69
Silk, degummed	8.8 –6.9	..	14.4
Silk, 47.5 percent relative humidity	9.8	..	..
80.0 percent R.H.	–6.2	..	..
90.0 percent R.H.	–5.0	..	..
Cotton, mercerized	7.85–	..	..
Cotton, 65 percent R.H.	–5.9	..	..
50 percent R.H.	–5.2	..	..
Rayon, viscose	8.3 –5.9	11.5	14.7[c]
	7.3[d]		11.5[b]
			1.3[c]
Viscose, strong	10.[d]	33.3	44.5[c]
			33.8[b]
			8.8[c]
Rayon, acetate	4.9 –3.45	..	6.1[b]
			1.7[c]
	8.3[d]	..	..
Wool	3.9 –2.5	..	5.1
Polyamide, 0 percent R.H.	4.95–4.8	..	..
50 percent R.H.	3.1	..	..
100 percent R.H.	1.17	..	..

[a] Dried.
[b] Air dried.
[c] Wet.
[d] Measured at very short times.

Dimensions and configuration

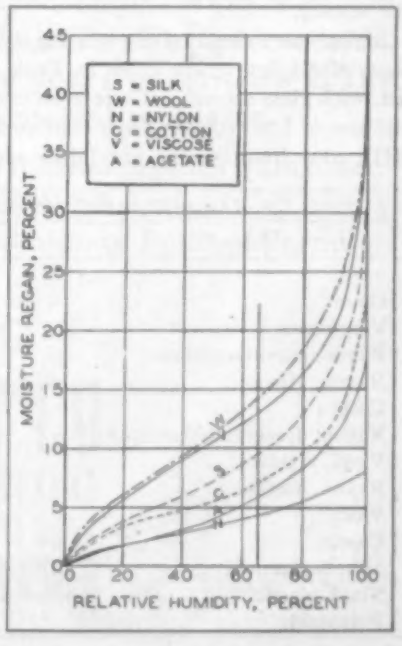
Although many of the characteristics of fibers, both physical and chemical, depend upon structure, dimensions and configuration also contribute importantly. Textiles made from continuous filaments differ markedly in appearance and feel from those made from staple fibers. The width or diameter of a fiber influences the stiffness of fabrics made from it, the abrasion resistance and the draping qualities. The configuration of cross section—whether round and smooth as in glass, polyamide and vinylidene-chloride fibers; flattened as in vinyl resin fibers; or lobed as in some rayons—has an important effect upon the appearance and feel of the product.

In Table II an attempt is made to give the present status of commercial fibers with respect to some of these characteristics. The cross sections are merely suggestive. It must be recognized that while cotton, wool and silk are definitely limited in dimensions and configuration, the other fibers can be varied far beyond the limits suggested by this table. The shape of the cross section can be varied. Hollow filaments, much finer filaments, crimped filaments, and rods and ribbons have been produced.

Physical properties of fibers

Data on the physical properties of the synthetic and common natural fibers, compiled in the next few tables, show why the synthetics have been in demand for military uses where tensile strength, flexibility, impact strength and toughness are essential. Cotton is a strong fiber, as can be seen from Table III, but its strength is not fully realized in cotton textiles. The ordinary rayons, with dry strengths of the order of 2 grams per denier, were the only synthetics available a few years ago. Today the strong types of these fibers possess over twice this strength while other synthetics are three or more times as strong—fitting them for essential military uses. The wet strength of some of the fibers is quite as good as the dry strength, a fact not true of rayons until recently.

Although high-strength fibers are required for some textile



1— Absorption of moisture by the fibers, from air of different relative humidities, is shown in this chart

TABLE VII.—RELATIVE STIFFNESS OF FIBERS

Fiber	*Average stiffness index*
Jute	4.0
Glass	2.9
Rayon, saponified acetate	0.80
Cotton	0.47
Polyamide, strong	0.41
Rayon, viscose, strong	0.23
Polyamide, regular	0.22
Vinyl, strong	0.22
Vinylidene	0.18
Silk, degummed	0.15
Rayon, cuprammonium	0.14
Rayon viscose, regular	0.11
Vinyl, regular	0.07
Rayon, acetate	0.05
Wool	0.04
Casein	0.02
Vinyl, elastic	0.0004

TABLE VIII.—RELATIVE TOUGHNESS OF FIBERS

Fiber	*Average toughness index*
Vinylidene	56.2
Polyamide, regular	45.0
Strong	40.6
Silk, degummed	40.2
Vinyl, elastic	30.0
Type 1	30.0
Type 2	24.7
Rayon, viscose, strong	19.5
Wool	19.5
Rayon, saponified acetate	18.9
Rayon, acetate	16.2
Rayon, viscose, regular	14.4
Casein	14.0
Rayon, cuprammonium	13.3
Cotton	11.6
Glass	5.8
Jute	2.0

uses, other properties may be much more important. Thus wool, which is near the bottom of Table III with a strength of only 1 to 1.7 grams per denier, is sufficiently strong for the uses to which it is put. Casein fiber and soybean protein fiber, still lower in the table, have been found suitable for certain purposes.

The elastic type of vinyl resin fiber, which is the weakest of all the fibers listed in Table III, is outstanding in its extensibility. It heads the list with respect to this property (Table IV). It has good elastic recovery, and has been used where rubber was the accepted material before the war. In general, the stronger the fiber, the less extensible it is. This is evident from a comparison of Tables III and IV.

The recovery of the fibers when subjected to a tensile load and then unloaded is shown in Table V. The extent of recovery depends upon the elongation, the time the load was on, and the time it was off. Glass, polyamide, vinyl resin, vinylidene and silk fibers rank high in recovery, but more data are needed for a thorough characterization of the behavior of the fibers under different conditions of loading and unloading.

Data on the modulus of elasticity of the fibers are given in Table VI. Like other characteristics, the modulus of a fiber varies greatly with moisture content and the time factors in the testing.

Smith[4] has calculated the relative stiffness of the fibers and some of his figures are given in Table VII. Jute heads the list, with glass second. There is an over-all range in relative stiffness of 1 to 10,000. On a relative toughness scale (Table VIII, also from Smith) vinylidene chloride heads the list, with polyamide second, and jute and glass at the bottom. The range in this property is 1 to 28. Again synthetic fibers are outstanding.

TABLE IX.—DENSITY OF FIBERS

Fiber	*Density*
	grams/cm.^{3}
Glass	2.56–2.52
Vinylidene	1.72
Rayon, cuprammonium	1.54–1.52
Rayon, viscose	1.54–1.52
Cotton	1.54–1.48
Rayon, deacetylated acetate	1.52
Vinyl, regular	1.36–1.34
Rayon, acetate	1.35–1.30
Wool	1.32–1.30
Casein	1.29
Silk, degummed	1.25
Vinyl, elastic	1.19
Polyamide	1.14

The densities of fibers are fairly well established in the literature. They are given in Table IX, and range from 2.56 for glass to 1.14 for polyamide fibers. The fact that data on fiber properties do not necessarily represent properties of finished products is well illustrated by these figures. It might be assumed that low density would give high bulkiness and covering power in the product. But these properties are also influenced by the form of the fiber, its cross section, its smoothness or roughness, whether continuous filament or staple, crimped or otherwise. Hosiery made from nylon, for instance, possesses greater sheerness than comparable silk hose, even though the fiber has lower density.

These tables of physical properties show the extent to which the synthetic fibers have extended the range of properties beyond those of cotton, wool and silk. They show that the fiber standing highest with respect to one property may stand lowest in another. Textile uses call for fibers having various combinations of properties, and it is not to be expected that any one fiber will be ideal for all uses.

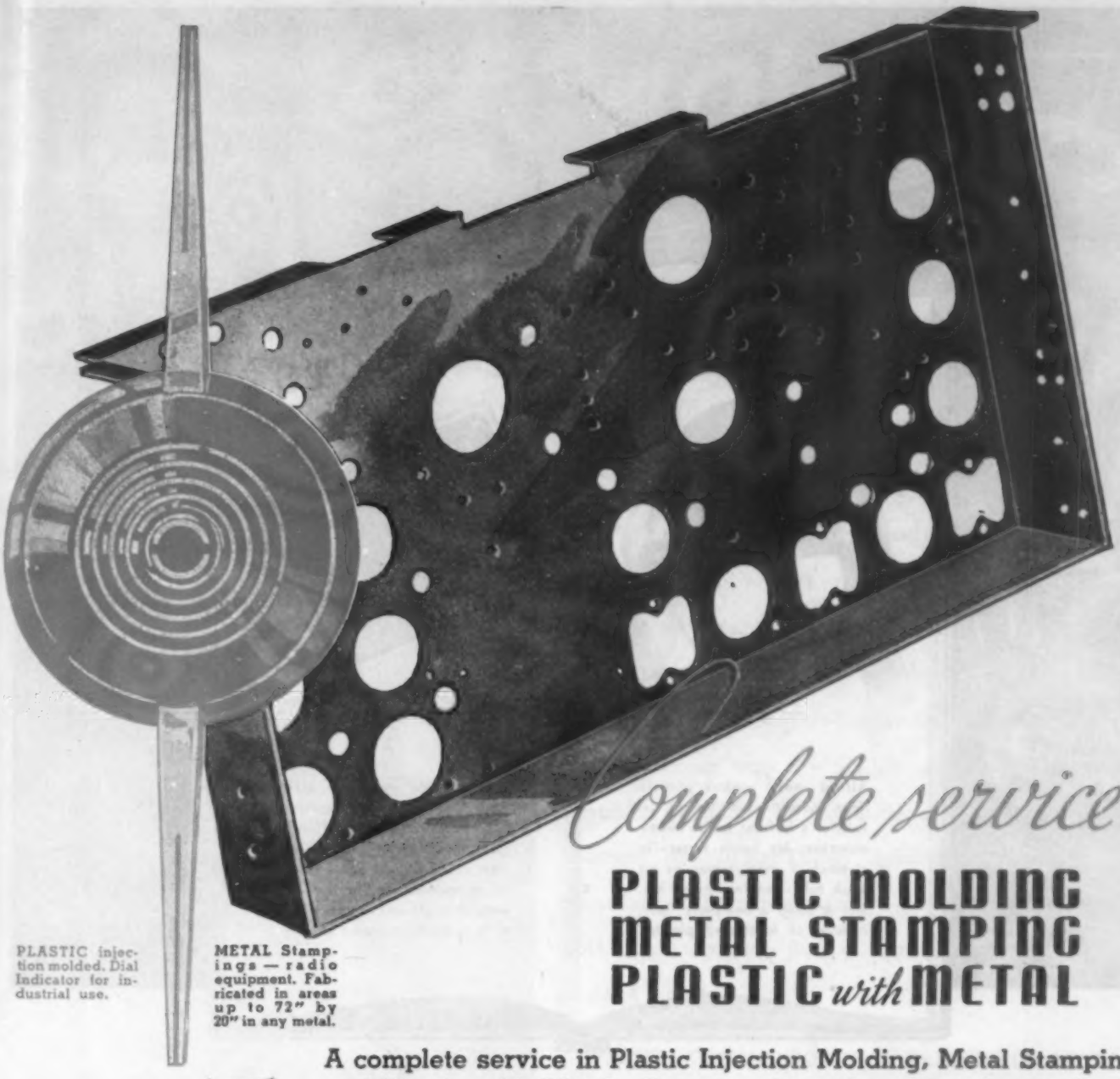
Chemical properties of fibers

What has been said about the physical properties of the fibers is applicable also to the chemical properties though the published data are somewhat sketchier and less amenable to comparison. It would be possible to go on and describe in detail numerous ways in which the synthetic fibers contribute new properties or extend the possibilities of the industry. Here only a few of them will be mentioned.

Vinylidene chloride and vinyl resin fibers are in general not affected by acids and alkalis and are resistant to many other chemicals. Polyamide and glass fibers are not affected under specified conditions. Consequently, these are the fibers that have been used in the chemical industries as filters for corrosive liquids and for other purposes.

The stability of the fibers in light varies from fair to good, depending upon the type just as with the natural fibers. With the exception of the regenerated cellulose rayons and the protein fibers, the synthetics are highly resistant to attack by mildews and other micro-organisms that play havoc with natural fibers. Cordage made from vinyl-resin and vinylidene-chloride fibers resists deterioration when it is exposed to sea water.

(*Please turn to page 194*)



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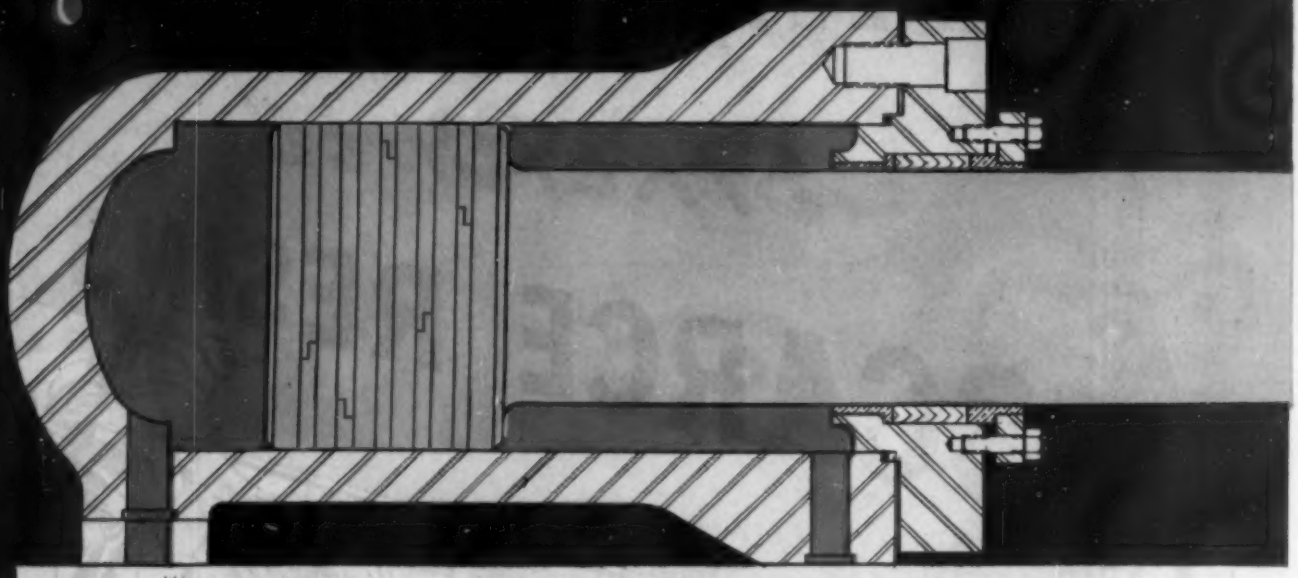

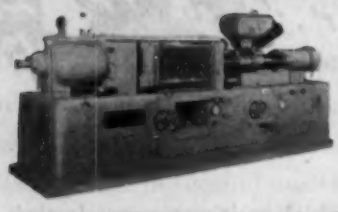

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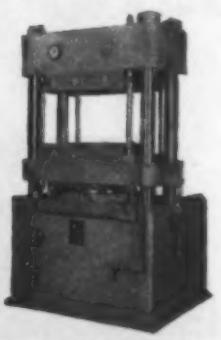

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Engineering

HOW MUCH "REAL MUSCLE" DO PLASTICS OFFER THE DESIGNER? J. Delmonte. Machine Design *16*, 99-104 (Dec. 1944). Methods of interpreting the values reported in the literature for the properties of plastic materials so that the designer may use these values properly in designing part of plastics are discussed. The maximum values of working stresses at room temperature are 2600 p.s.i. for rag-filled phenolics, 1900 p.s.i. for wood-flour-filled phenolics, 800 p.s.i. for polymethyl methacrylates, 400 p.s.i. for cellulose acetates and 1400 p.s.i. for Grade C. laminated phenolics. The changes in strength and dimension with temperature must also be considered. Other points considered are aging characteristics, effects of moisture and chemicals and fatigue properties.

TECHNOLOGY OF THE POLYETHYLENE GLYCOLS AND CARBOWAX COMPOUNDS. C. P. McClelland and R. L. Bateman. Chem. Eng. News *23*, 247-51 (Feb. 10, 1945). Solid polyethylene glycols and the liquid polyethylene glycols fill a need for water-soluble, unctuous compounds. They are used in many diverse applications such as binders, spreaders, ointment bases, coupling agents, dispersants, plasticizers, humectants, solvents, intermediates, sizing materials and special lubricants in many industries. The molecular weights of the liquid polyethylene glycols range from 200 to 1,000; the solid polyethylene glycols vary in molecular weight from about 1,000 to 7,000. Melting point, flash point, specific gravity, viscosity and aqueous solubilizing action all increase with increasing molecular weight. Water solubility, vapor pressure, hygroscopicity and solubility in organic solvents generally decrease with increasing molecular weight. The solvent power of the various organic solvating groups for the polyethylene glycols is in this order: hydroxyl, halogen, aryl, ketone, ester, ether and alkyl; the last two are essentially nonsolvent in content. Nineteen references are listed.

IMPACT-RESISTANT WINDSHIELD CONSTRUCTION. G. L. Pigman. Aeronautical Eng. Rev. *4*, 9, 11, 13, 15, 17, 19, 21, 23, 25, 123 (Jan. 1945). This report presents the results of tests carried out by the Civil Aeronautics Administration in which various types of aircraft windshield panel construction were subjected to impact with bird carcasses to simulate the collision of aircraft with birds in flight. A compressed-air catapult capable of projecting bird carcasses at velocities from 50 to 450 m.p.h. was used. The first phase of the test program with which the present report is concerned was carried out with flat double-pane, warm-air deicing-type windshield panels similar in size to the full Douglas DC-3 windshield. Bird carcass velocities required to obtain penetration of various glass, plastic and glass-plastic construction windshield panels are given. The type of double-pane deicing windshield which provides maximum impact resistance against collision with birds in flight for minimum weight of installation includes a laminated rear pane with thick vinyl plastic interlayer and glass faces, and extended plastic edges bolted into the windshield frame. A plastic sheet of methyl methacrylate or similar type elastically mounted behind or bonded to the rear glass face of the windshield will minimize the danger of flying glass splinters.

PAPER-BASE PLASTICS. PART II. PRODUCTION AT LOW PRESSURE. K. W. Pepper and F. T. Barwell. J. Soc. Chem. Ind. *63*, 321-9 (Nov. 1944). Although the tensile strength of reinforced plastics increases with the proportion of the stronger component—the fiber—the improvement is sharply limited by the need to fill all the voids in the paper; when the resin content is insufficient to fill the voids, the strength of the material is seriously reduced. It is shown that the main function of the pressure applied during bonding is to reduce the voids in the paper, and that the use of dense paper permits reasonably strong boards to be produced under pressures as low as 250 p.s.i. The effect of uneven distribution of pressure is discussed and the beneficial effect of the use of semi-flexible platens is discussed. Variations in the conditions of preparation are shown to have an important effect on the resistance to water of paper-base plastics, and it is demonstrated that the conditions giving rise to the highest value of Young's modulus result in a product having the minimum superficial dimensional movement. The following criterion for the production of paper-base plastics of good mechanical proportion appears to be generally applicable. The resin content and the moisture content of the impregnated paper should be just sufficient to permit the voids in the paper to be completely filled at the lowest pressure applied. This principle applies when production is carried out at high pressure or at low pressure, on a large scale or in the laboratory, but any lack of uniformity or reduction in pressure requires either the resin content or the moisture content to be increased, and this increase necessarily produces a falling-off in one or another of the desirable properties of the material. Hence the best laminated sheet produced at high pressure must have superior properties to any that can be produced at low pressure. Any process or modification which may be developed to improve the latter can be employed, with proper adjustment, to confer further improvement on the former. Laminated sheet can be produced at low pressures with acceptable mechanical properties. With the additional assistance of fluid pressure, further improvement is possible. Satisfactory production of laminated sheet at low pressures cannot be effected merely by the use of "high-density paper" or of special "low-pressure resins." It is necessary to secure a suitable combination of paper and resin so that the resin is distributed evenly through the thickness of each sheet of paper before pressing, and that the impregnated paper possesses a minimum of voids.

Chemistry

MECHANISM OF VINYL POLYMERIZATION. I. ROLE OF OXYGEN. C. E. Barnes. J. Am. Chem. Soc. *67*, 217-20 (Feb. 1945). An explanation is given for the frequently observed inhibiting action of oxygen in the photopolymerization of vinyl compounds and some additional data are presented. Oxygen exerts a similar inhibiting action on thermal polymerization as well, and both of these processes involve peroxide formation in preference to polymerization.

POLYMERIZATION OF METHYL METHACRYLATE WITH AMMONIUM PERSULFATE. B. N. Rutovskii and P. I. Panasyuk. Khim. Prom. *1944*, No. 5, 23-5; Chem. Abstracts *39*, 835-6 (Feb. 20, 1945). Methyl methacrylate monomer which was obtained by depolymerizing scrap polymer, was polymerized in water at 65 to 75° C. in the presence of 0.5, 1, 2, 3 and 5 percent ammonium persulfate. With the smaller amounts of catalyst the products were fine white powders; with 5 percent catalyst the product was spongy and hard to dry. The molecular weight of the product obtained when 0.5 percent ammonium persulfate was used was 345,000. When 3 percent catalyst was used the molecular weight of the product was 99,000. Chang-

ing the ratio of water to monomer did not affect the results appreciably. The addition of dibutyl phthalate to the reaction mixture resulted in products of lower molecular weight.

PHOTOPOLYMERIZATION OF VINYL ACETATE. C. Bagdassarian. Acta Phys. U. R. S. S. *19*, No. 4 266-85 (1944). The photopolymerization of vinyl acetate in mixtures with ethyl acetate and benzene was investigated. The rate of photopolymerization of pure vinyl acetate and in mixture with ethyl acetate is proportional to the square root of the intensity of incidental light. The temperature dependence of the rate of polymerization corresponds to an activation energy of 6.3 kg./cal. The length of the molecular chain is shown to be proportional to the monomer concentration and independent of the light intensity. The inhibitory effect of resorcinol and hydroquinone on the photopolymerization of vinyl acetate was studied. The inhibitor not only reduces the rate of polymerization, but also shortens the molecular chains. On the basis of the experimental data obtained, definite concepts are developed on the mechanism of photopolymerization.

POLYMERIZABLE ESTERS OF LACTIC ACID. α-CARBALKOXYETHYL ACRYLATES AND METHACRYLATES. C. E. Rehberg, Marion B. Dixon and C. H. Fisher. J. Am. Chem. Soc. *67*, 208-10 (Feb. 1945). α-Carbalkoxyethyl acrylates and methacrylates were prepared by acylating methyl, ethyl, isopropyl, *n*-butyl, isobutyl, cyclohexyl, allyl, methallyl and methylvinylcarbinyl lactates with acrylyl chloride, methacrylyl chloride or methacrylic anhydride. Polymerization of these unsaturated esters yielded colorless and transparent resins. The esters having two olefinic linkages yielded insoluble and infusible polymers. The cross-linking tendency of the bifunctional monomers was less than that of methallyl acrylate but greater than that of citronellyl, furfuryl or crotyl acrylate.

TRANSPARENT MODIFIED HEXAMETHYLENE TETRAMINE-PHENOL PLASTICS. G. S. Petrov, A. A. Pichugina and A. A. Tsunenko. Khim. Prom. *1944*, No. 5, 22-3; Chem. Abstracts *39*, 835 (Feb. 20, 1945). Transparent plastics were synthesized from phenol and hexamethylenetetramine. The product contains 7 percent nitrogen and 1 to 2.5 percent free phenol. The solubility in acetone is 13 to 15 percent; the impact strength 5 to 8 kg.-cm./cm.^{2}, the flexural strength 800 to 900 kg./cm.^{2}, the heat resistance 120° C., the break-down potential 23 kv/mm., the 24-hr. water absorption 0.1 percent and the increase in weight in potassium hydroxide and sulfuric acid for a period of 50 days is less than 0.4 percent.

Properties

SHEAR STRENGTH OF GLUE JOINTS AS AFFECTED BY WOOD SURFACES AND PRESSURES. J. W. Maxwell. Trans. A. S. M. E. *67*, 104-10 (Feb. 1945). An investigation was undertaken to determine accurately the pressures and type of surfaces that would insure the strongest glue joints. Photomicrographs of the various types of glue joints are presented and discussed, while graphs and photographs give evidence of the conclusions drawn. Only minimum pressure would be necessary if optically smooth surfaces could be prepared for wood, just enough to squeeze the glue line down to a thin continuous layer. Relatively smooth surfaces (planed) result in the strongest glue joints. Splintery surfaces (sanded and sawed) provide poor anchorage for glue and should be avoided. Weaker joints also result from splintery and irregular surfaces because they do not mesh well, hence the glue film is less even and thicker. Burnished surfaces, although smooth, do not produce good joints because of charring. Cold-setting urea-formaldehyde glue does not penetrate into hard maple wood, except into those cells, the cavities of which are open to the spread surface. A plot of the glue joint shear strength against thickness of glue joint shows that the shear strength drops sharply from about 3700 p.s.i. with glue film 0.0016-in. thick to 3000 p.s.i. with 0.0032-in. thick films, after which the strength changes little with thickness of glue joint. The shear strength of the glue is 2900 p.s.i.

PERMEATION OF HYDROCARBON GASES THROUGH RUBBER TUBING. M. J. Stross, J. L. Riley and H. M. Eby. J. Inst. Petrol. *30*, 153-67 (June 1944). Many types of natural and synthetic rubber tubing were tested for gas permeability. Where it is desired to avoid gas loss or change in composition, rubber tubing should not be used and the gas should not be allowed to contact rubber parts. Copper causes rapid deterioration of rubber by removing the sulfur. The most impermeable rubbery tubing was made of a polyvinyl alcohol composition. Polyvinyl chloride and chloroprene rubbers have low permeabilities and are superior to natural rubber in aging characteristics. For a given wall thickness, tubing of small diameters loses less gas than tubing of large diameters. Lower losses are noted for heavy-walled tubing than for thin-wall tubing.

EFFECT OF TEMPERATURE ON MECHANICALLY STRAINED ORGANIC MATERIALS. K. Frey. Schweiz. Arch. angew. Wiss. Techn. *10*, 39-56 (Feb. 1944). This is a review of existing data relating to the suitability and temperature limitation of various plastic materials available for use in equipment under strained conditions. The sections include the effects of temperature and time on the tension-extension diagram, dependence of elasticity and plasticity on temperature and stress, connection between chemical structure and mechanical properties, the practical determination of the resistance to deformation on heating and the permanent injury from excessive heating.

DOUBLE REFRACTION RESULTING FROM THE MIGRATION OF IONS OF FIBER MOLECULES IN AN ELECTRIC FIELD. W. Kuhn and H. Kuhn. Helv. Chim. Acta *27*, 493-9 (1944); Chem. Abstracts *38*, 5713 (Nov. 10, 1944). The combination of electrical and hydrodynamic forces present when a long molecule with a charge on one end migrates in an electric field exerts a torque tending to align the molecule. This should produce a double refraction. The anticipated double refraction should be proportional to the square of the field strength and to the concentration of the molecules. The double refraction is independent of the degree of polymerization. The results of experimental work with methyl cellulose verify this theory.

ON THE MAGNETIC DOUBLE REFRACTION OF POLYSTYRENE. W. Zvetkov and E. Frisman. Acta Phys. U. R. S. S. *19*, No. 4, 323-7 (1944). The magnetic double refraction of polystyrene of different degrees of polymerization was measured. The magnetic double refraction decreases slightly with an increase in the degree of polymerization. This observation agrees with the hypothesis of a cluster-like molecule, whereas a great increase in double refraction would indicate rod-like or slightly bent chain-like molecules possessing considerable anisotropy.

Testing

MEASURING THE STRENGTH OF PLASTIC CLOSURES. G. K. Scribner. Modern Packaging *18*, 117-21,162-3 (Dec. 1944). The history of molded plastic closures is reviewed. There is a need for standard methods of test and specifications for plastic closures. Methods which are being used are discussed. In one method, the cap is screwed on a thread until it breaks and the torque at the time of break is determined. A little grease or lubricant on the threaded surfaces will lower the apparent strength of the cap as much as 50 percent in this test. A modification of this test has been found to be more satisfactory. The cap is screwed on a threaded pin which has a loose pin up through the center. The diameter of the pin is about the same as the inside diameter of the bottle used for the caps. Force is then applied to the loose pin by means of a weight on a lever arm until the cap fails. Results of this test correlate well with service results on bottle capping machines. It is recommended that this latter method be

studied and improved with a view to making it a standard method for testing molded plastic closures.

CURRENT PROCEDURES IN OPERATING SO-CALLED ACCELERATED WEATHERING UNITS. R. W. Matlack. A.S.T.M. Bulletin No. 131, 34-6 (Dec. 1944). The results of a questionnaire on the operation of carbon arc accelerated weathering units are presented. There is a great lack of uniformity in testing by these machines. The variables in the test method must be controlled before comparable and reproducible results are obtained.

DETERMINATION OF HALOGEN IN PLASTICS. H. Hofmeier and W. Schröder, Kunststoffe *34*, 104-5 (1944); Chem. Abstracts *38*, 6423 (Nov. 20, 1944). A new method for determining the halogen content of plastic materials is described. The method is simpler and less accurate than the Carius procedure. The sample is decomposed by heating in a mixture of sulfuric acid and potassium nitrate and the liberated hydrogen halide gas is removed by a stream of carbon dioxide gas. The gas is absorbed in silver nitrate solution and the precipitated silver halide is determined gravimetrically. Results vary from good agreement with to 0.5 percent lower than those obtained by the method of Camus. Results obtained with polyvinyl chlorides are in good agreement with those obtained by the Carius procedure.

FRACTURES IN RODS OF POLYSTYRENE IN THE TENSILE TEST. H. Hesselbarth and A. Smekal. Kunststoff-Tech. u. Kunststoff-Anwend *13*, 33-8 (1934). Chem. Abstracts *38*, 6422 (Nov. 20, 1944). Pure tensile stresses which were increased uniformly were applied to cylindrical rods of polystyrene. When the rate of stress increase is less than 5 $g/m^2/sec.$, the occurrence of fractures below the breaking point can be observed with the proper lighting conditions. Interior fractures which occur when less than half the breaking load is applied influence the elongation and the gross structure of the fractured surface. These interior fractures are attributed to the existence of certain distributions in space of intrinsic tension within the rods. The fine surface cracks (crazing) which develop at a considerable distance from the breaking point are attributed to the result of a thin tension bearing surface layer which is also the essential cause of untimely crazing phenomena.

LEAKAGE CURRENTS. G. Pfestorf and E. F. Richter. Kunststoff-Tech. u. Kunststoff-Anwend. *12*, 1-11 (1942); Chem. Abstracts *38*, 6007 (Nov. 10, 1944). Leakage currents on the surface of plastics are discussed. The methods of testing and the influence of various factors on the results obtained are reviewed. Results of tests made on thermosetting plastics are reported.

Synthetic rubber

SWELLING OF SYNTHETIC RUBBERS IN MINERAL OILS. P. O. Powers and B. R. Billmeyer. Ind. Eng. Chem. *37*, 64-7 (Jan. 1945). The swelling of compositions of typical oil-resistant rubbers was measured in hydrocarbons having a wide range of solvent power. Compositions loaded with the same volume of SRF carbon black and no extractable softeners were studied at 25, 70, and 100° C. The aniline point of the hydrocarbon measures the tendency to swell, and up to 100 percent swelling the logarithm of the volume increase varies inversely with the aniline point of the oil. Swelling is greatest with the composition made from Neoprene GN and is progressively lower with those made of Stanco Perbunan, Hycar OR-15 and Thiokol FA. The swelling increases as the temperature is raised but the rate of increase is different with the various synthetic rubbers. Changes in composition during test may be responsible for these differences. Consideration of these results and published data indicates that the slope of the swelling-aniline point plots of compositions of a particular synthetic rubber does not change with temperature, loading or degree of cure. There is apparently a small difference in the slope as the type of synthetic rubber is changed. Tensile strength, elongation and durometer readings of the swollen compositions show a decrease with increased swelling, a slight decrease at 10 percent and a very pronounced drop at 100 percent swelling.

FATIGUE FAILURE OF GR-S TREAD STOCKS. H. Winn and J. R. Shelton. Ind. Eng. Chem. *37*, 67-70. (Jan. 1945). Tread type GR-S stocks were tested in a De Mattia-type flexing machine. Cures included a marked undercure, an overcure, and two intermediate cures. Tests were conducted at temperatures of 20, 40, 60 and 80° C. The oxygen concentration ranged from that in air to 0.05 percent by volume in nitrogen. Although a markedly undercure flexes quite well, the flex life of a G R-S stock decreases rapidly with longer curing times until the optimum cure is reached and then remains essentially constant. Flex life decreases rapidly with increasing temperature; the temperature coefficient of this change is 1.3 per 10° C. over the range 20 to 80°. The flex life is increased approximately 50 percent when oxygen is present only in traces; the critical oxygen content seems to be about 0.3 percent by volume, in that slightly higher values give results comparable to those obtained in air.

LIMITING LAW OF THE REINFORCEMENT OF RUBBER. H. M. Smallwood. J. Applied Phys. *15*, 758-66 (Nov. 1944). The effect of the filler upon the modulus of compounded rubber was calculated with the aid of some simplifying assumptions. From these calculations it is found that the increase in modulus, caused by the filler, is directly proportional to the volume loading, and is independent of the particle size of the filler. The stress system in the vicinity of a spherical filler particle was also calculated. A series of experiments was made to check these calculations. The results of these experiments indicate that carbon black is flocculated in rubber, and that P-33, Thermax and Gilder's whiting are completely dispersed in rubber. These last-named fillers give increases in modulus substantially in agreement with the calculations. It was also found that Kadox and XX zinc oxide give unusually large increases in modulus. These are ascribed to alteration of the type of cure of the rubber matrix. Catalpo clay showed excessive modulus because of high calender grain.

ADVANCES IN RUBBER DURING 1944. J. W. Liska. Rubber Age *56*, 293-8 (Dec. 1944). The progress in rubber technology during 1944 is summarized. Topics discussed include: properties of synthetics, compounding, continuous polymerization process, GR-S tires, airplane-tire-testing machine and a symposium on physics in rubber.

FURTHER STUDIES ON THE EFFECT OF TEMPERATURE ON THE RESILIENCE OF NATURAL AND SYNTHETIC RUBBER—II. H. C. Jones and E. G. Snyder. India Rubber World *110*, 535-7 (Aug. 1944). Neoprene GN developed the highest resilience of any of the synthetic elastomers measured over the range from 10 to 100° C. However it is about 5 percent lower than natural rubber over this range. Butadiene-acrylonitrile elastomers have a high resilience at elevated temperatures, but poor resilience properties at low temperatures and this condition can be ascribed to the thermosensitivity of the acrylonitrile portion of the polymer. The tensile and resilience properties of high zinc oxide GR-S stocks are profoundly influenced by plasticizers. A coumarone-indene resin improves tensiles, but degrades resilience; while the petroleum plasticizers, Naftolen and Bayol, have the opposite effect on physical properties. The resilience of both GR-S and natural rubber combinations are markedly affected by the sulfur content, and this phenomenon is particularly true with 10 and 20 parts of sulfur in the compound. Above room temperature, an increase in sulfur content results in an increase in resilience; below room temperature in impairment of resilience.

PLASTICS DIGEST

This digest includes each month the more important articles of interest to those who make or use plastics. Mail request for periodicals directly to publishers.

General

EFFECT OF SYNTHETIC RESINS ON CELLULOSE AND PROTEIN FIBERS. D. H. Powers. Ind. Eng. Chem. *37*, 188-93 (Feb. 1945). When cellulose fibers are impregnated with resin-forming solutions of unpolymerized urea-formaldehyde, melamine-formaldehyde or phenol-formaldehyde, these resin formers have little effect on the properties of the fibers until the resins are cured or polymerized within the fiber. Evidence shows that the resin is uniformly distributed through the fiber and, in certain cases, may actually react within the cellulose. Low concentrations of the resins formed within the fiber have pronounced effects on the physical properties, changing the elongation, elasticity, wet strength, moisture regain, resilience and dyeing properties. A new method of determining the degree of resin polymerization has been developed. Wool and protein fibers may be impregnated with resin-forming solutions; however, there is no evidence that they react with the wool protein. The medium in which the resin-forming materials are applied has a tremendous effect on the properties obtained, and fiber swelling is necessary to ensure thorough penetration. Electron photomicrographs are shown of treated and untreated fibers.

THE FUTURE OF SYNTHETIC PLASTICS. H. W. Melville. Proc. Royal Soc. Edinburgh *62*, 1-9 (1943-1944). This is a review of plastics from fundamental or molecular structure considerations.

LEO HENDRIK BAEKELAND. 1863-1944. AN APPRECIATION. W. P. Cohoe. Chem. Eng. News *23*, 228-32, 276 (Feb. 10, 1945). An account of the works of Leo Hendrik Baekeland and of the man.

LEO H. BAEKELAND HONORED AT MEMORIAL DINNER IN NEW YORK. Chem. Eng. News *23*, 448-9 (Mar. 10, 1945). The scientific accomplishments of Leo H. Baekeland are reviewed and their effect on the developments of today is shown.

COMMODITY REVIEWS. Chem. & Met. Eng. *52*, 127-42 (Feb. 1945). The sections on alcohol and solvents, plastics and rayon and synthetic fibers of the annual commodity review are of interest to those in the plastics industry. There were substantial gains in the production of vinyl resins and ethyl cellulose during 1944 but the production of other plastics was reduced because of shortage of raw materials. The estimated output for 1944 for all plastics was 700,000,000 lb. on an "as sold" basis. Outstanding developments were the increased production of polyethylene and the production of the organo-silicon resins. Rayon production increased again to 555,217,000 pounds. Other synthetic fibers in large scale production are nylon and milk casein yarn.

THE CONVERSION OF FERMENTATION PRODUCTS TO ELASTOMER INTERMEDIATES. J. J. Kolfenbach. Iowa State College J. Sci. *19*, 35-7 (1944). The synthesis of various chemicals which may be used in the production of elastomeric substances from 2,3-butylene glycol is described.

THE PRODUCTION OF RUBBER FROM FURFURAL. L. W. Burnette. Iowa State College J. Sci. *19*, 9-10 (1944). Furfural is converted to 1,3-pentadiene which is emulsion polymerized to a satisfactory rubber.

Materials

THE HISTORY OF POLYTHENE. P. C. Allen. Plastics (London) *9*, 68-9, 72-3 (Feb. 1945). The history of polythene is related. Starting with a fundamental research in July 1930, the first small amount of polymer was made in 1933, larger amounts under known controlled conditions in 1936, the first plant in 1937, a larger continuous pilot plant in 1938 and the first large scale manufacturing unit in 1939. The most difficult feature in the manufacture of this resin is the high pressure required in the vessels where the reaction takes place.

THE USE OF AGRICULTURAL PRODUCTS AS RAW MATERIALS IN THE PLASTIC INDUSTRY. J. A. Johnson. Iowa State College. J. Sci. *19*, 26-8 (1944). The formulation of plastic molding powders from agricultural products is described. One composition was made from furaldehyde, phenol, soybean meal, calcium oxide and inert fillers. Another consists of cresol and corncobs. Another was obtained by mixing the soybean resin and the corncob resin with asbestos filler. A molding powder was also made from hydrolyzed cornstalks, furfural, aniline and lime.

VENEER CHIPS IN THERMOSETTING PLASTICS. W. Koall and H. Schröter. Kunststoffe *34*, 98-100 (1944); Chem. Abstracts *38*, 6423-4 (Nov. 20, 1944). High-strength plastics are made by reinforcing phenolic resins with veneer chips. Best results are obtained with chips 25 mm. by 25 mm. and less than 1.0 mm. thick, bonded with 25 percent resin. The various strengths of the product made from beech chips, 0.5 mm. thick, bonded with 25 percent resin are as follows: notched bar impact strength 16 cm. kg./cm^2, Brinell hardness 20 kg./mm.^{2}, flexural strength 1200 kg./cm.^{2} and modulus of elasticity 90,000 kg./cm.^{2}. The properties are at least equal to and in some cases superior to the usual cellulose fiber-filled phenolic plastics of higher resin content. The veneer chip-filled phenolic plastics are suitable for use as bearing materials and in the manufacture of gears.

ALLYL ETHER OF STARCH. P. L. Nichols, Jr., R. M. Hamilton, L. T. Smith and E. Yanovsky. Ind. Eng. Chem. *37*, 201-2 (Feb. 1945). Soluble allyl ether of starch was prepared from starch acetate and also by direct allylation of starch. The compound is oxidized and polymerized to an insoluble and infusible product. Heat and paint driers accelerate the polymerization. Possible industrial uses of allyl starch as coatings, adhesives and plastic intermediates are discussed.

AMINO RESINS. J. Hofton. Chemistry and Industry No. 48, 410-12 (Dec. 2, 1944). The more important developments of the commercially important urea-formaldehyde and melamine-formaldehyde resins are reviewed. Molding powders, adhesives, laminates, protective coatings and paper and textile treatments are included in the discussion.

Molding and fabricating

FORMING OF VINYL RESINS. E Romer. Kunststoffe *34*, No. 4, 77-8 (1944); Chem. Abstracts *38*, 6425 (Nov. 20, 1944). Methods for making sheets and films of polyvinyl chloride and polyvinyl chloride acetate are reviewed.

PLATED PLASTICS. S. H. Brams. Iron Age *155*, 62-5 (Feb. 1, 1945). The plating of plastics with metals is discussed. In this process the plastic is silvered by reduction in the presence of tin and hydrochloric acid. The metal bonds tightly to the plastic. The object is then electroplated in the usual manner. Acrylic, phenolic and urea resins and cellulose acetate butyrate are the most readily plated. The vinyl resins are more difficult to plate. Metal plating increases the tensile strength, decreases water absorption and increases impact strength. Some of the products being plated are cigarette cases,

aircraft antenna, door handles, letter openers, decorations, jewelry, buttons, escutcheons, insignia and bottle caps.

HOT-FORMING OF PHENOLIC LAMINATES. H. C. Guhl. Mechanical Eng. *67*, 175-9 (Mar. 1945). The best hot-forming phenolic laminates are made from special resins and fabrics. The essential properties, however, conform to Grade C specifications. The viscosity of the special resin is lower than that of the phenol and cresol resins. The fabrics have a high elongation from crimp and stretch in the yarns and the tensile strength is high. The heat-distortion temperature and the hardness of the hot-forming materials are lower than that of the usual laminates. The best forming temperature is 300 to 350° F. and the pressure 50 to 100 p.s.i. Details concerning procedures are given. Properties of these laminates are tabluated.

Applications

POLYETHYLENE—ITS PACKAGING POSSIBILITIES. C. S. Myers. Modern Packaging *18*, 122-3, 158, 160 (Dec. 1944). Polyethylene film has properties which make it suitable for packaging. The film has an extremely low vapor transmission rate, 3 g./m.² 24 hr. for a 1-mil. thick film, and a low moisture absorption, 0.01 percent/24 hr. Polyethylene film is not affected by immersion in boiling water, can be heat-sealed, remains flexible at low temperatures, is insoluble in all solvents at room temperatures, is soluble in carbon tetrachloride, trichloroethane, toluene and xylene at 50 to 60° C., and is colorless, odorless, tasteless and nontoxic. The plastic can be molded, extruded, welded, cemented by hot-melts, machined, calendered, embossed, blow-molded, swaged and drawn. Polyethylene is considered for molding closures, collapsible tubes and closure liners. In film form this plastic should be suitable for packaging and for the manufacture of calendered film, paper and cloth coatings.

ADHESIVES FOR METALS AND NONMETALS. K. Rose. Metals and Alloys *20*, 959-63 (1944). The methods of application and uses of adhesives containing a rubber-like substance combined with a synthetic resin are described. These adhesives, Cycleweld, Reanite, Pliobond, Durite S-3024, Meltbond and Plastilock 500 are used in the joining of wood and metals.

ALKYD RESINS IN THE PAPER INDUSTRY. G. Leffingwell and M. A. Lesser. Paper Ind. Paper World *26*, 858-9 (1944). This is a review of the application of alkyd resins in the paper industry.

PLASTICS—A SUMMARY OF POSSIBLE APPLICATIONS TO MOTOR VEHICLES. Automobile Engineer *35*, 65-7 (Feb. 1945). This is a summary of possible applications of plastics to motor vehicles. The applications considered are: 1) body building, 2) facia boards, window fillets and interior fittings, 3) coverings for steering wheels and handrails, 4) thermal insulation, 5) mechanical and electrical components, 6) windshields and windows, 7) wire coatings and cable coverings and 8) waterproof covering and flooring.

ARTIFICIAL SPONGES. C. A. Minors. British Plastics, *16*, 549-50 (Dec. 1944). The manufacture of artificial sponges from viscose is described

THE "HAMILCAR" GLIDER. British Plastics *17*, 14-15 (Jan. 1945). The world's largest wooden aircraft, the British "Hamilcar" glider is described. Solid wood timbers, plywood and paper laminated plastics are used in the construction. The parts of the glider are bonded together with urea-formaldehyde resin.

A CRITICAL ANALYSIS OF ACRYLIC RESINS USED FOR DENTURE CONSTRUCTION. E. W. Skinner. Illinois Dental J. *13*, 433-40 (1944). The changes which occur during polymerization are stressed in this paper on the physical properties of the acrylics used for denture construction.

ADHESIVES AND SEALANTS. J. F. Mason. Automotive and Aviation Ind. *92*, 18-19, 98-116 (Jan. 15, 1945). Various commercial adhesives and sealants which were evaluated in the laboratory and found suitable in service for use on aircraft are discussed. The adhesives are based on neoprene, butadiene copolymers, Thiokol, cellulose esters, cellulose ethers, vinyl resins, acrylic resins, phenolic resins, urea resins and Cycle-Weld. The sealants are based on zinc chromate containing compounds, Thiokol, phenolic varnishes, butadine-acrylonitrile copolymer and sodium silicate.

Coatings

TRENDS IN THE DEVELOPMENT OF ROSIN-BASE RESINS. F. G. Oswald. Official Digest Fed. Paint and Varnish Production Clubs No. *239*, 458-73; Paint Ind. Mag. *59*, 384-91 (1944). A review of the chemistry, properties and applications of rosin derivatives with particular reference to protective coating.

THE HOT-LACQUER PROCESS. A. C. Hopkins, Jr. Paint, Oil Chem. Rev. *107*, No. 17, 9-11, 26 (1944). The formulation and properties of hot-applied lacquers are reviewed. The hot-process is sound, economical and eliminates the principal fault of cellulose nitrate lacquers, namely, low solids.

MECHANISM OF HEAT BODYING LINSEED OIL. H. E. Adams and P. O. Powers. Ind. Eng. Chem. *36*, 1124-5 (Dec. 1944). Changes in the properties of linseed oil during heat bodying were studied in an attempt to correlate such changes with the chemical reactions which are believed to occur. In addition to properties usually given by other investigators, hydrogen absorption and heat of combustion at various stages of heat bodying were determined. The data obtained are in substantial agreement with published results. Polymerization with the formation of a six-membered ring between two fatty acid groups is clearly indicated. There fatty acid groups may also combine, but no estimate of the extent of this reaction is possible at present. The formation of an intermediate compound is indicated by the results. This compound has a low iodine value but apparently is not a true polymer. It may be an intrapolymer formed by combination of two fatty acid groups in the same glyceride. Whatever the structure of the intermediate compound may be, it rearranges during later heat bodying to form an interpolymer.

POLYPENTAERYTHRITOL DRYING OILS. H. Burrell. Ind. Eng. Chem. 32, 86-9 (Jan. 1945). Polypentaerythritols are ether polymers of pentaerythritol. Dipentaerythritol and tripentaerythritol are of economic significance. They are high-melting, white solids, insoluble in water. The unsaturated fatty acid esters of the polypentaerythritols resemble tung oils in their ability to body rapidly, to form water- and alkali-resistant varnishes, and to withstand weathering. The esters are simply prepared by heating the fatty acids and alcohols above 230° C. with agitation. Esterification rates and bodying rates are given. The polypentaerythritol drying oils are compared with other synthetic and natural oils as to drying time, hardness, durability and increase in yellowness.

INDUSTRIAL WHITE ENAMELS. M. A. Glaser. Ind. Finishing *21*, No. 1, 36, 38, 40 (1944). The properties of the white enamels containing titanium dioxide and zinc oxide are reviewed. The film-forming material may be alkyd, urea-formaldehyde, chlorinated rubber, vinyl, styrene and acrylate resins and cellulose derivatives.

PHOTOMICROGRAPHIC METHOD OF FORECASTING BEHAVIOR OF PAINT FILMS. J. D. Butcher and E. H. Rackham. Paint Manuf. *14*, 344-7 (1944). A microscopic examination of films of organic coatings which are undergoing exposure tests gives a reliable forecast of the breakdown of the coating previous to deterioration visible to the naked eye.

SURFACE COATINGS FOR ROTPROOFING WOOD. C. Y. Hopkins and B. B. Coldwell. Canadian Chem. & Process Ind. *28*, 849-51 (Dec. 1944). A relatively rapid method for determining the effectiveness of surface coatings for rotproofing wood is described.

U. S. Plastics Patents

Copies of these patents are available from the U.S. Patent Office, Washington, D. C., at 10 cents each.

COATING. G. Lindh (to Udylite Corp.). U.S. 2,367,880, Jan. 23. A coating for metals comprising vinylidene chloride and vinyl chloride copolymer, a solvent and a finely divided siliceous material.

COATING. J. C. Lum and T. J. Keating (to Westinghouse Electric and Mfg. Co.). U.S. 2,367,954, Jan. 23. A coating made of an acetamide and ethyl cellulose.

MOLD. W. F. Reibold and R. P. Magnenat (to Waterbury Companies Inc.). U.S. 2,367,962, Jan. 23. An apparatus for molding an all-plastic button.

SEALING DEVICE. M. H. Sidebothan (one-half to H. M. Russell). U.S. 2,368,046, Jan. 23. A device for sealing an annular joint on a container with a liquid thermoplastic material.

COATING. C. Bogan (to Commercial Solvents Corp.). U.S. 2,368,062, Jan. 23. A coating comprising cellulose triacetate, a nitroparaffin, an alcohol and tetrachloroethane, dioxane, or a similar solvent.

DECORATIVE ARTICLES. N. Barbieri (to Uncas Manufacturing Co.). U.S. 2,368,085, Jan. 30. Thermoplastic articles are decorated by softening the surfaces with heat and impressing a design thereupon.

SCREEN. B. M. Bodde. U.S. 2,368,099, Jan. 30. A picture projection screen comprising a sheet of transparent material on which is coated a film of plastic material containing a random array of microscopic birefringent crystals.

SNAP FASTENER. A. Boenecke (to Alien Property Custodian). U.S. 2,368,100, Jan. 30. A snap fastener of synthetic plastic material comprising a stud member, a socket member and a slotted base for each member.

WRAPPER. C. E. Johnson (to Reddir, Inc.). U.S. 2,368,140, Jan. 30. A wrapper comprising an outer water-impervious layer, an inner layer composed of a resin-coated paper, and an intermediate adhesive layer comprising a sugar.

TEXTILES. R. W. Moncrieff and H. Bates (to Celanese Corp. of America). U.S. 2,368,154, Jan. 30. The extensibility of textile fibers of organic derivatives of cellulose is improved by stretching in hot water, subjecting to the action of a swelling agent, washing, and finally drying.

RESIN. J. E. Shand to Ellis Laboratories, Inc.). U.S. 2,368,165, Jan. 30. Resins are prepared by treating pine oleoresin with sulfuric or phosphoric acids or their alkali metal acid salts and removing the acidic substances after a substantially solid mass has been obtained.

COVER. H. G. Sydenham, H. W. Clowe and A. E. Du Bois. U.S. 2,368,272, Jan. 30. A gas-protecting cover for the head and body comprising an upper transparent single sheet of gas-resistant material and a lower portion comprising two opaque sheets of the same material, all three sheets being fastened along the edges with an adhesive tape providing a gas-tight seal.

MOLD. W. Rose (to Taylor Fibre Co.). U.S. 2,368,327, Jan. 20. A mold comprising a pair of boxes adapted to telescope one within the other, each containing a normally solid material capable of flowing under pressure whereby an object may be molded between the surfaces as they are pressed together.

PRESS. J. H. Bent and R. W. Pearson (to Stupakoff Laboratories, Inc.). U.S. 2,368,404, Jan. 30. A press for the extrusion of plastic materials.

FURANE RESIN. F. B. Root and C. W. Virgin (to Ellis-Foster Co.). U.S. 2,368,426, Jan. 30. The resinous reaction product obtained by heating furfuryl alcohol and ammonium thiocyanate.

RESIN. G. F. D'Alelio (to General Electric Co.). U.S. 2,368,451, Jan. 30. A heat-hardenable resin comprising the reaction product of a mono salt of a polyaminotriazine and a product resulting from a partial reaction between a polyaminotriazine and formaldehyde.

PLYWOOD ADHESIVE. A. J. Golick and T. W. Dike (to I. F. Laucks, Inc.). U.S. 2,368,466, Jan. 30. An adhesive for plywood is prepared by reacting cresol and formaldehyde in the presence of an emulsifying agent in an aqueous ammonia solution having a pH of 10.5 to 12, and adding an aqueous solution of soluble blood.

POLYMER. A. H. Gleason and W. J. Sparks (to Standard Oil Development Co.). U.S. 2,368,538, Jan. 30. In the polymerization of a di-isobutenyl substituted aryl compound, the reaction mixture is cooled to below —10° C. and a solution of aluminum chloride in an alkyl halide is added as a catalyst.

CELLULOSE DERIVATIVES. F. W. Hochstetter (to Hochstetter Research Laboratories, Inc.). U.S. 2,368,660, Feb. 6. Flammable cellulose derivatives are rendered non-flammable by including the reaction product of hexamethylenetetramine and oxybenzylalcohol in their formulation.

SCREEN. H. W. Thomas. U.S. 2,368,689, Feb. 6. An open-mesh screen comprising monofils of metallic wire coated with a thermoplastic synthetic resin.

CASEIN. W. F. Tschudin (to Sandoz A. G.). U.S. 2,368,690, Feb. 6. Fibers and masses of casein are rendered water-insoluble by treatment with a solution of a salt of trivalent chromium at 50° C. or above this temperature.

MOLD. C. F. Marschner (to McDonnell Aircraft Corp.). U.S. 2,368,717, Feb. 6. A mold for pressure-molding plastic articles.

PROPELLER BLADES. F. E. Weick (to Engineering and Research Corp.). U.S. 2,368,734, Feb. 6. Wooden laminae are impregnated with a heat-hardenable resin, a number of laminae are superposed, heated and compressed to a predetermined thickness to form a slab, and finally a number of slabs are united to form a block.

MOLDING PRESS. P. E. Flowers (to Hydraulic Development Corp. Inc.). U.S. 2,368,756, Feb. 6. A molding press for molding plastic material.

CELLULOSE ESTERS. B. T. Lamborn (to Hercules Powder Co.). U.S. 2,368,764, Feb. 6. Mixed esters of cellulose are prepared by reacting cellulose, acetic acid, acetic anhydride, another acid anhydride, a chloro-fluorohydrocarbon and a catalyst.

ADHESIVE. M. C. Moore (to Hercules Powder Co.). U.S. 2,368,767, Feb. 6. An

adhesive comprising a film-forming water-soluble amylaceous or proteinaceous substance and, as a plasticizer, a polymerized terpene.

MOLDING COMPOSITION. J. S. Tinsley (to Hercules Powder Co.). U.S. 2,368,788, Feb. 6. A dry molding composition comprising cellulose acetate, a petroleum - hydrocarbon - insoluble pine wood resin and a plasticizer.

VALVE. C. J. Schuler (to Interstate Aircraft and Engineering Corp.). U.S. 2,368,887, Feb. 6. A poppet valve comprising a metal core and a plastic body molded about the core.

FABRIC SIZE. J. W. Stallings (to Rohm and Haas Co.). U.S. 2,368,948, Feb. 6. A fabric composed of multifilament yarn is made more transparent by sizing with an aqueous dispersion of a copolymer of an acrylic acid ester and acrylonitrile.

VINYL RESIN. J. E. Smith (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,368,949, Feb. 6. Aqueous solutions of saponified polyvinyl esters are freed of impurities by treatment with activated charcoal.

ACRYLIC RESINS. R. E. Leary and B. M. Marks (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,369,057, Feb. 6. A shaped mass of methyl methacrylate containing voids is treated by subjecting to a temperature of 140° C. and a pressure of 3000 p.s.i. while immersed in an aqueous solution of sodium acetate.

DECORATIVE SURFACES. H. E. Walter (to Wood Conversion Co.). U.S. 2,369,092, Feb. 6. An impression device for intaglio designs in a plastic mass.

ROSIN ESTER POLYMERS. A. L. Rummelsburg (to Hercules Powder Co.). U.S. 2,369,109, Feb. 6. Polymerized rosin esters are refined by heating at 250 to 325° C. for a period of time sufficient to improve the color of the material.

ROSIN ESTERS. G. R. Anderson (to Hercules Powder Co.). U.S. 2,369,125, Feb. 13. A rosin ester of high oxygen resistance is prepared by heating a mixture of a natural rosin and an alcohol at 285 to 325° C. for more than 10 hours.

DOPE. L. C. Amberson. U.S. 2,369,200, Feb. 13. A flammable nitrocellulose dope is rendered non-flammable by mixing with zinc chloride, settling until there is a sharp stratification between the dope and the chloride, and finally removing the excess chloride and recovering the dope.

RESIN. J. K. H. Seiberlich. U.S. 2,369,371, Feb. 13. The resinous condensate of diaminotetrazine and an aldehyde.

RESIN. N. E. Tillotson. U.S. 2,369,379, Feb. 13. A composition of ethyl cellulose and a resin such as cativo or copaiba.

CELLULOSE DERIVATIVES. J. A. Roux (to Rouxite Co.). U.S. 2,369,411, Feb. 13. Cellulose of high alpha content is mixed with an alkali metal hydroxide in water, a hypochlorite is added, the mixture is agitated, and carbon dioxide is added to form a cellulose oxychloride.

PROTEIN DERIVATIVE. M. E. Cupery (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,369,439, Feb. 13. A protein is reacted with the reaction product of formaldehyde and a salt of sulfamic acid.

POLYETHYLENE. G. H. Latham (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,369,471, Feb. 13. The softening point of polyethylene is raised and its flexibility is improved by blending with a hydrocarbon or halogenated hydrocarbon polymer.

FILM. G. F. Nadeau (to Eastman Kodak Co.). U.S. 2,369,484, Feb. 13. A process for making film of a cellulose derivative.

HOLLOW ARTICLE. E. L. Perry (to Universal Winding Co.). U.S. 2,369,488, Feb. 13. A method for molding a hollow article from a mass comprising a fibrous material and a thermo-setting resinous binder.

PROTEIN DERIVATIVE. J. F. Walker (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,369,503, Feb. 13. The reaction product of a protein and a formaldehyde derivative of a sulfamic acid salt prepared under alkaline conditions.

FILAMENTS. E. T. Weibel (to Irvington Varnish and Insulator Co.). U.S. 2,369,506, Feb. 13. An apparatus for hot drawing filaments from molten, organic, filament-forming material.

POLYMERS. C. E. Barnes (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,369,520, Feb. 13. Lower alkyl esters of acrylic and methacrylic acids are polymerized by removing dissolved oxygen, heating in a mold in an oxygen-free state and in the presence of one percent of a peroxide catalyst.

EXTRUSION DEVICE. R. T. Fields (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,369,553, Feb. 13. An extrusion apparatus for molding plastic material.

MOLDING. D. E. Lucid (to General Motors Corp.). U.S. 2,369,583, Feb. 13. A device and method for molding curved articles from plastic materials.

CAST SHEETS. B. M. Marks and C. E. Ranck (to E. I. du Pont de Nemours and Co., Inc.). U.S. 2,369,593, Feb. 13. Sheets of a heat polymerized material are prepared by filling a cell, comprised of two plates separated by a compressible gasket, with the heat polymerizable material, immersing the cell in a heated liquid bath, and retaining it in the bath until polymerization is complete.

TRIM PANEL. E. A. Burns (to Woodall Industries, Inc.). U.S. 2,369,658, Feb. 20. A laminated trim panel comprising a panel foundation, a lamination of wadding, a trim material, and a resinous composition covering the trim material and extending through it into the wadding.

RESIN. C. G. Moore (to Glidden Co.). U.S. 2,369,683, Feb. 20. A resin is prepared by heating a mixture of a monoglyceride produced by esterification of glycerol with a drying or semi-drying oil fatty acid and maleic anhydride, and then slowly adding a drying or semi-drying oil.

ABRASIVE. N. P. Robie and O. L. Mahlman (to Carborundum Co.). U.S. 2,369,689, Feb. 20. An abrasive article comprising abrasive grains and a hardened binder comprising the reaction product of a neutral unsaturated monomeric material and an unsaturated ester of an aliphatic alcohol and a polybasic acid.

RESIN. G. F. D'Alelio (to General Electric Co.). U.S. 2,369,948, Feb. 20. The reaction product of an aldehyde and a triazole derivative.

VINYL RESIN. M. M. Safford (to General Electric Co.). U.S. 2,369,985, Feb. 20. A composition comprising the copolymer of a vinyl halide and a lower aliphatic vinyl ester and a methyl chlorostearate.

LAMINATE. H. W. Hall. U.S. 2,370,033, Feb. 20. A laminated wood article is prepared by gluing laminations with casein glue, impregnating the laminated structure with urea-formaldehyde resin and curing with heat and pressure.

POLYVINYL ACETALS. J. Dahle (to Pro-phy-lac-tic Brush Co.). U.S. 2,370,126, Feb. 27. Articles of polyvinyl acetal are prepared by forming an article of solid polyvinyl alcohol, pretreating the formed article with a catalyst in solution in a non-solvent for poylvinyl alcohol, and reacting in a reaction bath containing a monomeric acetal to produce polyvinyl acetal.

CONDUIT. E. S. Reid (to Sonoco Products Co.). U.S. 2,370,193, Feb. 27. A conduit comprising two paper tubes secured together by a film of adhesive in fixed telescopic arrangement and impregnated throughout with a water-resistant thermoplastic resin.

BOOKS AND BOOKLETS

Write directly to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent post-paid at the publishers' advertised prices.

Varnish Constituents

by H. W. Chatfield

Published by Interscience, Inc., 215 4th Ave., New York, N. Y.

Price, $7.00

The taming of the phenol-formaldehyde reaction by Dr. Baekeland in 1909, not only established the modern synthetic resin industry but also laid the foundation for revolutionary developments in the protective coatings industry. Statistics show that approximately forty percent of the total resin production goes into this market. Hence this book on the raw materials used in varnish making will be of interest to a large sector of the plastics industry.

The author of this book is varnish research chemist and departmental manager of a British firm. The comprehensive scope of the text is best indicated by a listing of the subjects of the various chapters: Oils, acids, monoglycerides, natural resins, solvents, modified natural resins, synthetic resins, solvents, plasticizers, driers, antioxidants, asphaltums and pitches, waxes, rubber and chlorinated rubber.

G.M.K.

Fabricating Methods for Lumarith, Celluloid and Similar Thermoplastic Materials

Celanese Plastics Corp., division of Celanese Corporation of America, 180 Madison Ave., New York 16, N. Y.

This new manual will answer many of the most frequently asked questions on the fabricating of plastic materials and should be valuable to all fabricators of plastics.

Realizing the growing need for the type of handbook that would present manufacturing methods in a simple, easily assimilated manner, the company condensed 75 years of research and scientific study so that the new fabricating manual might assist the industry.

Written in simple and direct language, comprehensively diagrammed and illustrated, the 136-page manual contains complete information on the fabricating of thermoplastics including primary and secondary cutting procedures; the fabricating of film, foil and sheet stock; the various molding processes and methods for finishing all types of articles made from these materials.

The manual will be reprinted from time to time in order to incorporate any corrections or revisions resulting from developments in fabricating techniques. In a brief foreword to the book, the company invites such corrections and suggestions from the leader.

Paper limitations make it necessary at this time to limit distribution to one complimentary copy to any executive in the industry who requests the book on company letterheads. Individuals, including students, may purchase additional copies at $1.00 each.

Transactions of the Institute of the Plastics Industry, 1944

Published by the Institute, Windsor House, Victoria St., London, S. W. 1

Price 15 shillings **256 pages illustrations**

This book is a refutation of the assumption that the report of the transactions of an organization must necessarily be dull. Opening with the routine matters of officers and objects of the group, the book goes on to present the analyses of various current developments in plastics, placing particular emphasis on the relation of these materials to other industries and the possibilities for postwar developments in the field of plastics. A feature which broadens the scope of each article is the presentation of the discussions which resulted from the reading of each paper.

The Chemical Age Year Book—1945

Published by the Chemical Age, Benn Bros., Ltd., Bouverie House, Fleet St., London, E. C. 4

263 pages

This year book is of special significance to members of the trade who are interested in following the progress of plastics in Great Britain and the activities of the British members of the industry. Besides reviewing the plastics events of the year, it includes a comprehensive buyers' guide; a "who's who" of the industry and its representatives in the Government agencies and various plastics control legislation enacted. A bibliography of the chemical industry presents the relevant books in that field, and various data sheets and physico-chemical tables form a ready reference source.

Plastics from Farm and Forest

by Earl F. Lougee

Published by the Plastics Industries Technical Institute, 122 E. 42nd St., New York 17, New York

Reprint price, $1.00 **160 pages illustrations**

Many books have been written on the developments and applications of the materials which comprise the basis of the plastics industry, but few of them present the origins and background of its organic components as lucidly as does this small manual of Mr. Lougee.

Already an accepted and welcome part of the student's and interested onlooker's library, this book in its new format brings its information to a wider group.

Coming as it does at a time when the effects of Mr. Lougee's death are still clearly felt, it serves as a reminder of his outstanding contribution to the plastics industry, and, in its simplicity of presentation, as a source of encouragement to those who would like to become a part of this industry but are deterred by the apparent complexity of its structure.

Dictionary of Engineering and Machine Shop Terms

by A. H. Sandy; revised by I. E. Berck, Ph.D.

Published by the Chemical Publishing Co., Inc., Brooklyn, New York

Price, $2.75 **154 pages**

This dictionary makes it possible for the student or new entrant into the engineering industry to understand an entire list of words with which he would never become familiar except through being constantly exposed to their usage, under circumstances directly relating to their meaning. One example of this clarification of terms, which the plastics industry might well emulate, is the description of the words "hub" and "hob," which are often used interchangeably. It serves to point up the brief but effectual treatment of controversial words with which this book is filled.

★ IN MANY CASES, THE FAILURE of an application results from a lack of familiarity with the proper handling of the material used. To obviate such failure in the heat treatment of hobbed cavities, Midland Die and Engraving Co., Chicago, Ill., has released a booklet to its customers and prospective users on "How to Heat Treat Hobbed Cavities by Midland." The ten pages of the booklet contain explicit directions illustrated for greater clarity.

★ DESIGNED FOR USE BY tooling experts and engineers, "Plastic Tooling at Lockheed" in its second edition serves as a tooling manual to acquaint its readers with the progress made in the development of plastic tools. This 52-page manual, presented by the Manufacturing Research Dept. of Lockheed Aircraft Corp., combines detailed drawings with the textual matter.

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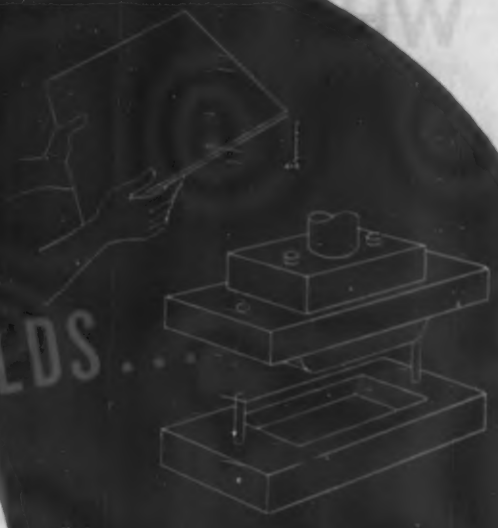

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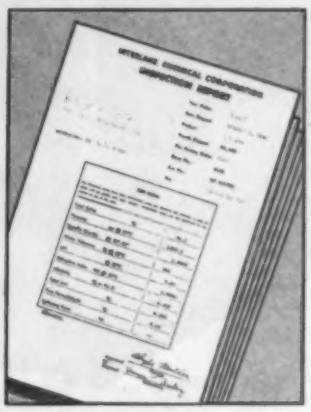

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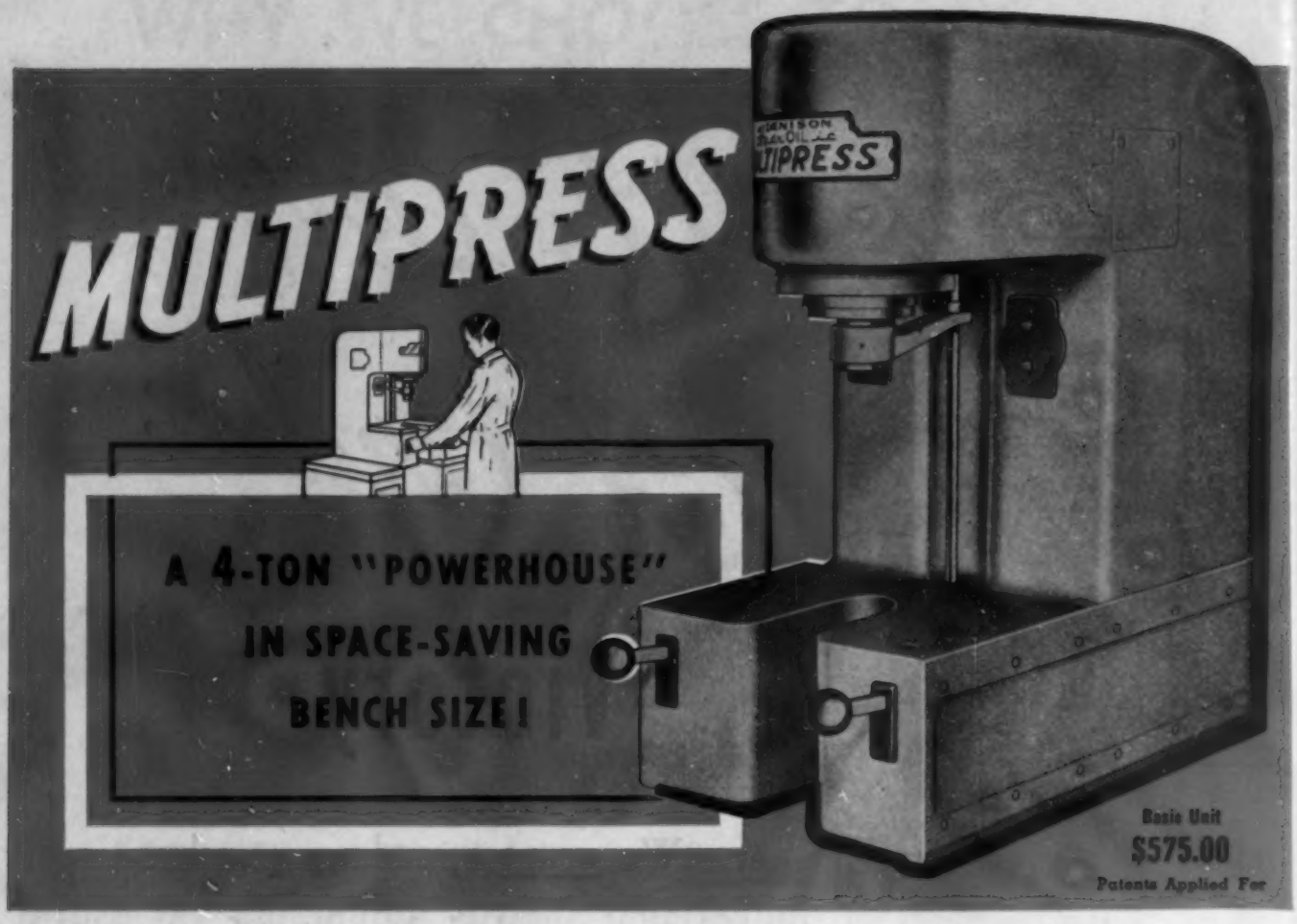

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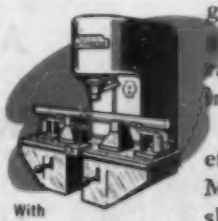
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Photos — Courtesy The Kampa Manufacturing Co.

1000-P

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"The bigger the family—the better the service"

THERE's nothing like a big cooperative family for all-round service! With our facilities, experience and technical knowledge in handling all kinds of orders, we can give you a quick impartial analysis of *your* packaging problem. Result? The *right* package for your product.

Continental *is* a big family offering a wide variety of packages—metal containers, liquid-tight paper containers and cups, fibre cans and drums, steel pails and various heavy duty containers.

We're meeting the needs of America's armed forces now. But keep your eye on Continental! And on Continental's trademark, too! The Triple-C stands for *one* company with *one* policy—to give you only the best in quality and service.

Tune in: "REPORT TO THE NATION" *every Saturday over coast-to-coast CBS network*

Continental Fibre Drums—Continental has a full line for shipping dry products, resins, rosins, asphalt, etc.; also grease and other semi-liquids. Continental drums cover a wide range of sizes; "Stapak" drums (illustrated) from 2 to 32 gal.; "Fiberpak" drums from ¾ gal. to 67 gal.; "Leverpak" drums from 12 to 75 gal.; Special drums from 15 to 55 gal. capacity.

CONTINENTAL CAN COMPANY, INC.

CONTINENTAL PAPER DIVISION

FIBRE DRUMS The Container Co., Van Wert, Ohio

LIQUID-TIGHT FOOD CONTAINERS — Boothby Fibre Can Co., Roxbury, Mass.

PAPER CUPS AND FOOD CONTAINERS — Mono Containers, Newark, N. J.

COMBINATION PAPER AND METAL CONTAINERS

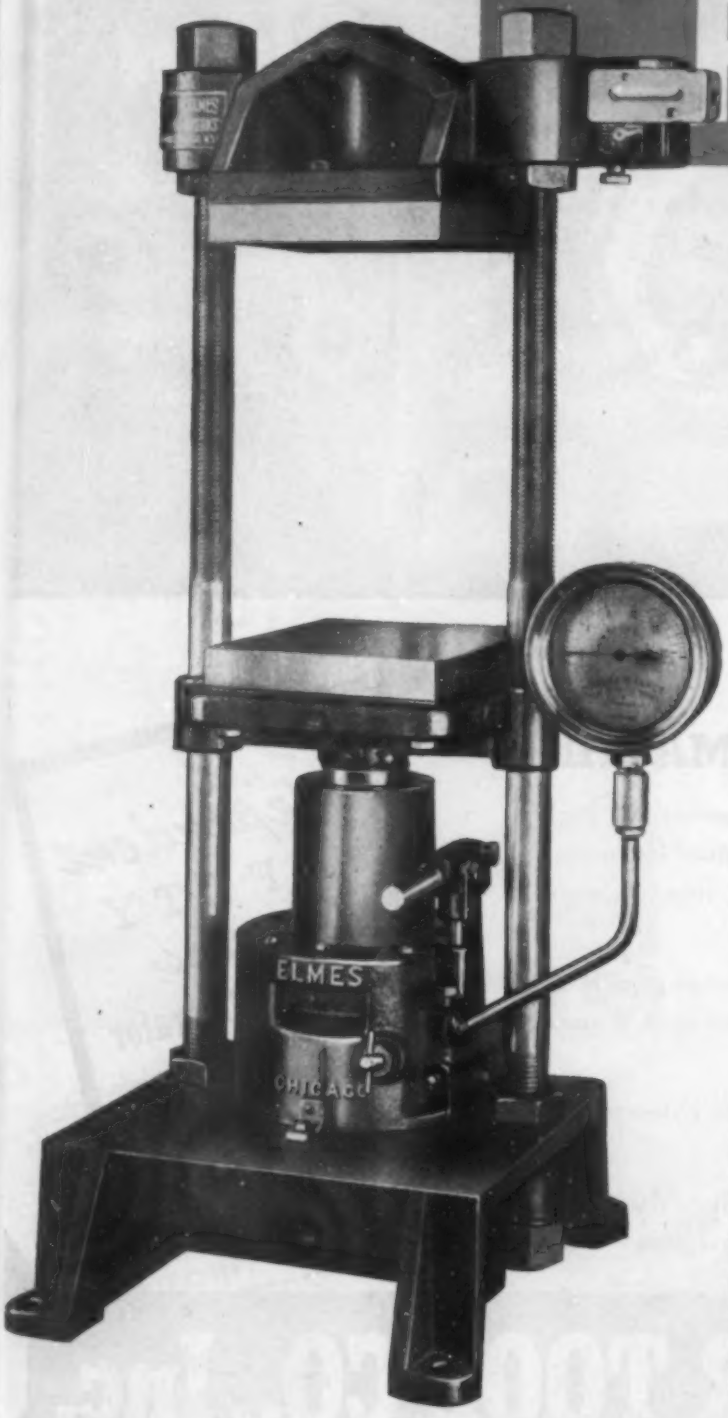
Headquarters: 330 W. 42d St., New York 18, N.Y.

13 Plants — Sales offices in all principal cities

LABORATORY

Built to Elmes Big-Press Standards of Performance

PRESSES



Small presses that are *built right* save time and money for plastic molders.

—by pre-testing new molds under *actual* production conditions.

—by helping to determine the *right* combination of temperature, curing time, and pressure before starting new runs.

—by testing specimens.

—by *speeding* research experiments.

—and, on short lots and small jobs, by serving as a *capable* production press.

A good laboratory press is a *most welcome* and versatile addition to plant facilities—in machine shop, tool room, maintenance and inspection departments, and wherever quick, easily controlled pressure is needed.

Ask us for Bulletin 1035A. It gives prices and complete specifications on 20, 30, and 50-ton models. All have Elmes precision-built hydraulic units with *honed* cylinder and wing-type *regrindable* valve.

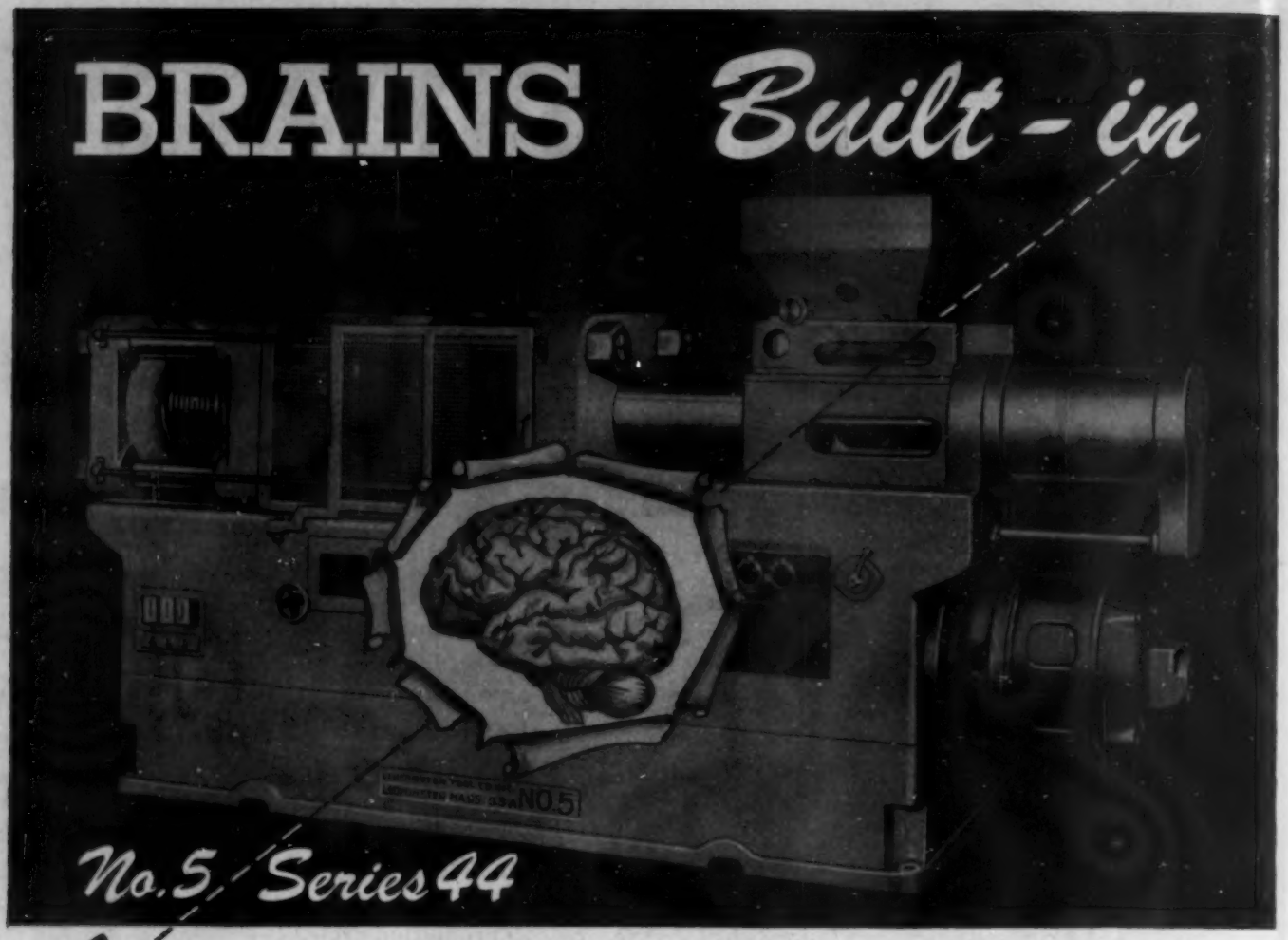
ELMES HYDRAULIC EQUIPMENT

Two-column, 20-ton Model No. 3429. Over-all dimensions: 17" x 15" x 41" high. Opening: 0" to 16". Platen: 8" x 8" with full guides encircling both columns. Ram: 3" diam., 6" stroke. Weight: 425 lbs. Price, with gauge and lever extension, $168.00. Electric hot plates with "Off-On" switch, $40.00; with thermostatic control and temperature-setting indicator for 110-220 V., A.C., $55.00. Other accessories: See Bulletin No. 1035A.

ELMES ENGINEERING WORKS *of* AMERICAN STEEL FOUNDRIES, 225 N. Morgan, Chicago 7, Ill. • *Also Manufactured in Canada*

METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES

BRAINS *Built-in*



Léominster

INJECTION MOLDING MACHINE

New precision die-alignment, achieved by one adjustment of a single screw, eliminates multiple die adjustment and resultant inaccuracies. This improved adjustment control prevents flooding, reduces rejects to minimum.

"Central-shaft" centralized movable plate support equalizes pressure distribution, and full length pin support in the heavy-duty toggle assembly gets rid of toggle trouble.

Uniform thrust action of the multiple knock-out pin system prevents cramping, breakage and wear of ejection parts.

For Precision Production, Speedy and Safe — Depend on Leominster

2 *Independent* SAFETY *Factors*

Protect The Operator

Machine cannot function while *either* door is open, or when either of the two independent safety controls becomes inactive. Thus utter protection of operator, and "automatic insurance" are effected. Front and back guard doors open individually.

LEOMINSTER TOOL CO., Inc.

LEOMINSTER, MASSACHUSETTS

MANUFACTURERS OF MACHINES AND MOLDS FOR THE PLASTICS INDUSTRY

Waterbury Companies, Inc. have the Facilities for Designing and Manufacturing Products, Parts and Assemblies to Customer's Specifications in Plastics and Metals, or in combinations of both.

MOLDINGS OF MERIT *by* WATERBURY COMPANIES, INC.
COMPRESSION • TRANSFER • INJECTION

EXCELLENCE in mold making is Waterbury's forte. Their complete facilities are unequaled for intricate mold work, for Waterbury has the equipment and ability to build special machinery when required for unusual operations. When fine handwork is called for Waterbury has the craftsmen. Waterbury Companies' Engineers & Designers welcome your inquiries. Address Dept. B

BUY MORE WAR BONDS — **HASTEN VICTORY**

PLASTIC CUSTOM MOLDERS
•
METAL SUNDRIES
EYELETS & TERMINALS
•
UNIFORM & DRESS BUTTONS
•
LIGHTING FIXTURES
•
TOYS
•
Our Engineers and Designers will work with you

WATERBURY COMPANIES, INC.
Formerly Waterbury Button Co., Est. 1812
WATERBURY, CONNECTICUT

WHY TRANSFER MOLDING IS ECONOMICAL—II.

If price-per-unit produced means anything to your company, then transfer molding means a lot. For transfer molding brings unit cost down by, among other things, sharply reducing finishing costs.

Older methods of molding phenolics, ureas and melamines require placement of the thermosetting compound in the mold cavity, then closing of the mold. Under pressure, some of the compound will flow out at the mold's parting line, resulting in a residual "flash" such as that on the round object shown at upper right. The "flash" in this piece ranges from .0135" to .024" in thickness. Its removal is an expensive, time-consuming series of operations that raises the cost-per-unit.

In transfer molding, which uses conventional, compression-type presses, the thermosetting compound is changed to its plastic state in a chamber connected with the mold, which is already closed. It flows under pressure from the chamber into the mold. After curing, the mold is opened for removal of the parts. The "flash" at the mold's parting line is thus held to a minimum. In most cases, nothing has to be done about it, as with the cylindrical objects shown at lower right. The "flash" line, which has not been touched, runs almost indiscernibly along the side of each piece. The connecting material will break cleanly at the slightest touch.

SHAW

SHAW INSULATOR COMPANY

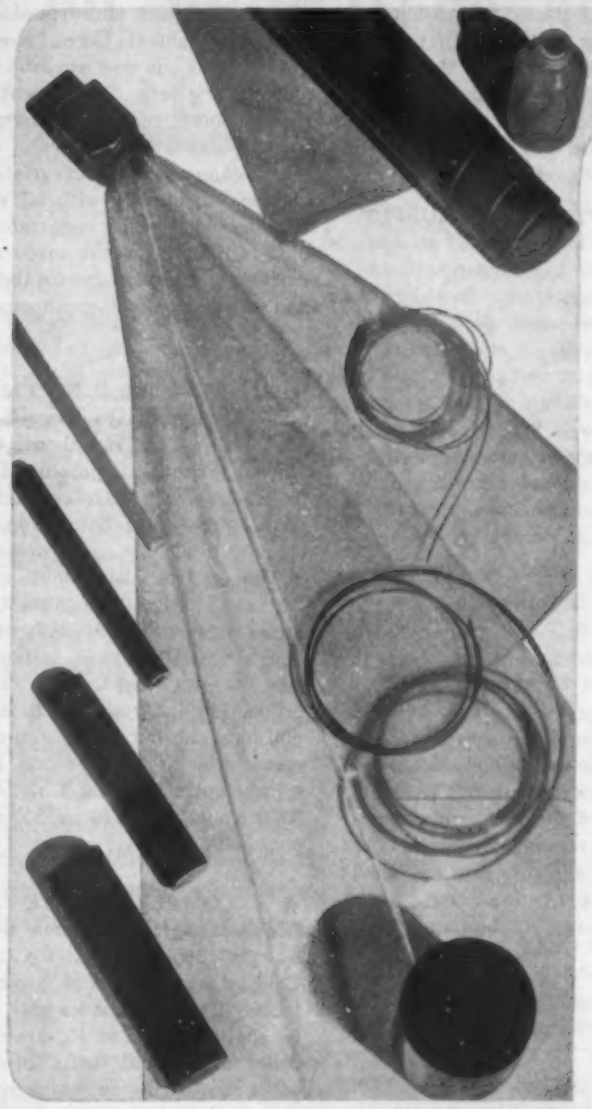
100 COIT STREET, ★ IRVINGTON 11, NEW JERSEY

Licensed transfer molders near you offer the numerous advantages of this patented method. A list of them, a bulletin on another reason why transfer molding is economical, a bulletin on "Why Transfer Molding Gives Fine Inserts", and reprints of technical articles by Shaw engineers are available on request.

A broad range of plastic materials and processes is covered by the resources of Shaw and the Plax Corporation, Hartford 5, Conn. Write either one for advanced help in applying plastics to your needs.

For the names of licensed transfer molders near your own plant . . . write Shaw.

DATA ON PLAX POLYETHYLENE PRODUCTS



Polyethylene is supplied by Plax in film, slab, rod, tube, fiber and blown ware forms, in a wide range of sizes and in all colors, from clear to pearlescent. The unusual characteristics of this material are as follows:

MECHANICAL

Elongation, 77° F, %	30-500
Tensile Strength, p.s.i. (-70°, 77°, 170°F)	5000; 1700; 700
Modulus of Elasticity in Tension, p.s.i. x 10^5	.146
Flexural Strength, p.s.i.	1700
Rockwell Hardness	13R
Impact Strength, ft. lbs. per in. of notch; ½" x ½" notched bar Izod tests, 4 ft.-lb. machine, room temperature	Does not break
Water Absorption, 24 hrs., %	0.01
Specific Gravity	.92

ELECTRICAL

Volume Resistivity, ohm, cms. (50% rel. hum. at 25°C)	10^{17}
Dielectric Strength, short-time volts per mil, ⅛ in. thick	1000

Frequency	Dielectric Constant	Power Factor
60	2.3-2.4	.0002-.0005
10^3	2.3	.0002-.0005
10^6	2.3	.0002-.0005

THERMAL

Distortion Temperature, °F	122
Softening Point, °F	219-239
Specific Heat, cal. per °C per gram	0.5
Burning Rate	Ignites and burns slowly
Thermal Expansion, 10^{-5} per °C	10.5
Thermal Conductivity, 10^{-4} cal. per sec. per sq. cm/1°C per cm.	7

CHEMICAL EFFECTS

Weak Acids	None
Strong Acids	None
Weak Alkalis	None
Strong Alkalis	None
Alcohols	None
Edters	Slight
Ketones	Slight
Hydrocarbons	Considerable

The outstanding electrical properties, toughness and resistance to moisture of Plax polyethylene products adapt them to a vast range of uses. For data on sizes and adaptability to specific applications, write Plax.

The following illustrated literature is available:

Several bulletins on Plax polystyrene products and how to machine them.

Data on Plax cellulose acetate, cellulose acetate butyrate, and methacrylate products.

An article on Plax's blown products.

Ethyl Cellulose and styramic are among the other materials offered by Plax in various forms. In cooperation with the Shaw Insulator Company, Irvington 11, N. J., Plax can give you help covering nearly all plastic materials and methods. For such help, or for any of the literature listed above . . . write Plax.

NEW MACHINERY AND EQUIPMENT

★ A RECTIFYING ELECTRONIC unit which provides variable voltage on a direct current output is a new development from General Electric Co., Schenectady, N. Y. This new electronic unit consists of full-save four-tube kenotron rectifier, a filter to limit voltage ripple to within one percent, meters, indicating lights and manual controls. It is assembled in a steel cabinet equipped with dust filters and a motor-driven ventilating fan. A dolly is supplied for portable application.

A solenoid-operated discharge switch is interlocked with the main supply to short-circuit the rectifier and discharge the filter capacitor through a resistor when power is shut off. Interlocks are also provided to de-energize the equipment when the housing doors are opened.

★ THE CHARLES E. FRANCIS CO., Huntington, Ind., has developed a very practical variation to a small, general-purpose hydraulic press. This steam plate press, which can be obtained in a 30 by 30 by 2-in. size, has a 153-ton capacity. It is equipped with a motor-driven pump unit, automatic pressure and temperature controls and eleven steam plates. Among the features which the manufacturer claims to be valuable to the user are extremely husky plate support, "V's" for easy loading, and the fact that strain rod nuts have a special locking device to prevent unscrewing. Although this press was designed to handle laminated plastic for war items, it is also ideal for a wide variety of other plastic work.

★ THE REDESIGNED SCHIEFER-Kline tautness meter, originally developed to test the tautness of doped fabrics of airplane sections, is being manufactured by Sherman W. Frazier, Washington, D. C. Since different types of dope impart different degrees of tautness and affect the tautness of experimental panels and airplane sections when subjected to varying temperatures and moistures, this instrument provides a true gage of their efficacy.

The primary consideration in the redesign of this machine—that of protecting the sensitive gages and mechanism against weathering when used out of doors—also effects greater protection when it is used in a manufacturing or an assembly plant.

★ TYPICAL OF THE ALL-STEEL aircraft style construction used throughout the general design of Hy-speed tools manufactured by Reimuller Bros. Co., Franklin Park, Ill., is their line of single acting rams which serve as the prime source of force for hydraulic equipment. Using 4200 p.s.i. as the basic pressure, a complete range of lightweight steel rams are available in sizes varying from $^1/_2$- to 6-in. diameter for assisting motivation or supplying force in many applications. If used with standard foot-power units or motor-driven pumps and valves manufactured by the company, forces from 500 lb. to 40 ton can be maintained. These rams are easily and cheaply serviced and most of them can be furnished with spring return.

★ MAXANT BUTTON AND SUPPLY Co., Chicago, Ill., has developed an open face punch press for work not practicable on any other punch press. Suited to a wide range of small punch press work, it functions equally well on metal, cloth, rubber, wood, synthetics and plastics, and is said to produce short runs at long run costs. The body is heavily reinforced without unnecessary weight, and the various elements of the press are designed for maximum wear and smooth operation. A motor-driven V-belt drive operates with high efficiency.

★ HEAT AND DUST WORRIES IN line contact grinding and polishing are claimed to be abolished in a new wet-belt surfacer developed by Porter-Cable Machine Co., Syracuse, N. Y. This machine is said to have all the advantages of the wet-belt machine used for platen machining. Cool operation speeds cutting, prevents belt loading and eliminates burring operations, besides increasing production per man hour. The model is also equipped with a self-contained recirculating system and an individual motorized pump.

★ MORTARS AND PESTLES WHICH cannot become contaminated have been developed and manufactured by New England Carbide Tool Co., Cambridge, Mass., for use in scientific research laboratories. These implements incorporate boron carbide in their construction, a material which is said to be the hardest commercial material ever made by man. This material, which is non-metallic, cannot charge and therefore will not pick up lint, dust or metal particles which might contaminate the materials being ground.

The mortar is constructed with a steel body and is lined with a boron carbide insert which is ground to the proper shape and then polished to a mirror finish. The pestle has a steel handle with a polished boron carbide rod mounted at one end.

★ A NEW FIVE-IN-ONE HYDRAULIC control valve has been incorporated in the Do-All G-10 surface grinder, providing increased speed, efficiency, simplicity of operation and greater accuracy. This new machine, according to its manufacturer, Continental Machines, Inc., Minneapolis, Minn., will grind a surface with precision to six micro inches.

★ AN IMPROVED TABER abraser, designed and manufactured by Taber Instrument Corp., North Tonowanda, N. Y., is now available in a complete testing set. The present design of this machine, used for determining the wear or abrasion resistance of practically every material subject to surface abrasion, includes an abraser with all accessories, together with a specimen table for running tests under wet or moist conditions. An illuminated magnifier for the inspection and examination of specimens is also a part of this set.

★ A NEW POLISHING LATHE FOR odd-shaped parts is announced by Crozier Machine Tool Co., Hawthorne, Calif. The Crozier vacuum grip polishing lathe is said to handle parts such as oil-can bodies, spun shapes, and flat stampings which cannot be held by chuck or collet—parts of copper, brass, aluminum, magnesium, zinc and plastic as well as steel. It generates its own vacuum without piping or glands, starts and stops instantly and releases the work rapidly, providing low-cost production. All work is held firmly for polishing and burnishing and many other operations. The lathe has a threaded spindle and is furnished with an 1800 or 3600 r.p.m., 220–440 or 550-volt, three-phase 50 or 60-cycle motor.

★ A COMPLETE LINE OF FLEXible shaft angle drills is now being offered by the Zephyr Mfg. Co., Inglewood, Calif., manufacturers of aircraft precision tools. The line includes both 18- and 30-in. shafts coupled to 45, 90 or 360° angle drills, unattached shafts for coupling to other angle drills, or shafts with threaded spindle for direct use without an angle drill. The flexible shaft is of latest design, with a piano wire stress-relieved core encased in oil-resistant rubber and filled with oilless-type bronze bearings. The drill heads are precision made, with heavy-duty bevel gears and non-friction ball and needle bearings to give long and trouble-free service.

★ TRICO FUSE MFG. CO., MILWAUkee, Wis., is producing a new line of leak-proof air guns for blowing chips, dust and dirt, and kicking out finished parts and operating air-driven tools. An important feature of these air guns is ease of operation, a slight finger-tip flex of the hose being sufficient to discharge the amount of air required. Air pressure helps to close the valve tightly when fingertip pressure is released. These guns are available in a complete range of hose diameters and in three styles.

for HIGH frequency insulation at LOW cost specify STYRAMIC

Electronic engineers in need of highly efficient insulating materials for a wide range of structural parts, have found Monsanto's Styramic fits uniquely into their requirements . . .

- . . . high heat distortion temperature (184°-187°F.)
- . . . excellent dielectric characteristics (see chart)
- . . . excellent molding (compression, injection, or extrusion) and machining qualities
- . . . non-inflammability
- . . . low water absorption (0.046%, 24 hrs. immersion)

Styramic is well suited to most electronic applications. Where unusually high operating temperatures are met over long periods of time Styramic's companion product, Styramic HT, Monsanto's Polydichlorostyrene, is recommended.*

For complete information and experienced technical assistance in adapting Styramic to your particular needs or operations, write, wire or phone: MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Massachusetts.

*Both Styramic and Styramic HT are restricted for military end uses for the present.

PHYSICAL PROPERTIES OF STYRAMIC	
Specific Gravity	1.358
Clarity	opaque
Color range	grey and natural only
Odor	none
Taste	none
Rockwell hardness	M72
Burning rate	chars slightly but will not burn
Molding methods	injection—compression extrusion
Molding qualities	excellent
Machining qualities	very good
Tensile strength, p.s.i.	3,000–3,500
Flexural strength, p.s.i.	6,000–7,000
Impact strength, Izod, ft. lbs. per in. notch	0.3
Heat distortion points, A.S.T.M.	184°–187°F.
Water absorption after 24 hours immersion	0.046%
Effect of acids	none except strong non-oxidizing acids attack
Effect of alkalis	none

Dielectric Constant, 300 kc., dry	2.55
Dielectric Constant, 300 kc., 96 hrs. water immersion	2.60
Power Factor, 300 kc. dry	0.0004
Power Factor, 300 kc., 96 hrs. water immersion	0.0004
Loss Factor, 300 kc. dry	0.001
Loss Factor, 300 kc., 96 hrs. water immersion	0.001

The broad and versatile family of Monsanto Plastics includes: Lustron polystyrenes • Cerex heat resistant thermoplastics Vinyl acetals • Nitron cellulose nitrates • Fibestos cellulose acetates • Thalid for impression molding • Resinox phenolics Resimene melamines • Forms in which they are supplied include: Sheets • Rods • Tubes • Molding Compounds • Industrial Resins • Coating Compounds • Vuepak, rigid, transparent packaging materials.

MONSANTO PLASTICS

SERVING INDUSTRY...WHICH SERVES MANKIND

WASHINGTON ROUND-UP

R. L. VAN BOSKIRK, Washington Editor

Machine allocations

Machine allocations for the second quarter of 1945 were as follows: Arnold Brilhardt, Ltd., one 8 oz. machine, Leominster Mach. & Tool Co.; All Plastics Mfg. Co., one 8 oz., Leominster Mach. & Tool Co.; St. Louis Plastic Moulding Co., one 6 oz., Lester-Phoenix Co.; Plastic Molding Corp., one 6 oz., Lester-Phoenix Co.; Pro-Phy-Lac-Tic Brush Co., one 4 oz., Hydraulic Press Mfg. Co.; Chicago Die Mold Mfg. Co., one 9 oz., Hydraulic Press Mfg. Co.; American Phenolic Corp., one 9 oz., Hydraulic Press Mfg. Co.; Master Plastic Molding Corp., one 9 oz., Hydraulic Press Mfg. Co.; Bolta Co., one 8 oz., Improved Paper Mchy. Co.; Hoosier Cardinal Corp., one 8 oz., Reed-Prentice; Gits Molding Corp., one 8 oz., Reed-Prentice; Victor Metal Products Corp., one 8 oz., Reed-Prentice; Elmer E. Mills Corp., one 8 oz., Reed-Prentice; Molded Insulation Co., one 8 oz., Reed-Prentice; Arpin Products, Inc., one 8 oz., Reed-Prentice; Peerless Molded Plastics, Inc., one 8 oz., Reed-Prentice or Leominster Mach. & Tool; Gibson-Thomson Co., one 8 oz., Reed-Prentice; Richardson Co., one 16 oz., Hydraulic Press Mfg. Co.

Authorizations declined: Peerless Molded Products Co. and Gibson-Thomson Company.

The small number of machines available for allocation in the second quarter of 1945 is due primarily to the manufacturers' inability to obtain critical components such as castings, motors, pumps and controls. This is the basic reason why many machines allocated in the previous quarter cannot be delivered until May and June. In the future only those machines which the War Production Board feels reasonably sure, after checking availability and delivery of components, can be delivered in the specified quarter will be considered for allocation, regardless of the number of machines a manufacturer may build.

The next allocation will be made June 1, 1945, and will cover machines that manufacturers can actually deliver in the third quarter. Approval of machines will be based strictly on their order of essentiality for items needed for the Armed Services.

Fillers

Molders generally do not consider that their molding material production is dependent upon the supply of many different types of fillers such as woodflour, walnutshell flour, and cotton fillers. These raw materials are actually just as important to their continued war production as phenol and formaldehyde. During the past few months, resin manufacturers have been confronted with increasing difficulties in obtaining a steady flow of these fillers.

The production of wood filler has been curtailed in several plants because of inability to obtain the wood chips or wood waste. In the Northeast, wood chips have been in the open and subsequently a high moisture content has prevented normal grinding operations. In order to grind woodflour, it is most desirable that the wood contains as little moisture as possible to produce material of uniform mesh.

Walnutshell flour, not used too extensively in molding materials but to a greater degree in plywood adhesives, has decreased in supply mainly because of labor conditions. There is only one manufacturer of walnutshell filler and it is expected that this plant will very shortly operate at a greater tonnage.

Cotton fillers are most important for all high impact strength molding materials including the compound used in the production of M-52 fuzes. Cotton fillers are dependent upon the supply of cotton rags, and cotton rags are becoming tighter because of a general shortage of material available for textiles, which forces producers of shirts and underwear to trim closer and decreases the trim available for all uses. It is reported that many dealers in the rag business are exceeding price ceiling and causing a black market in the rag business. This problem is being studied by WPB's Textile Division and remedial measures are expected to be announced soon.

Resorcinol resin adhesives

The military has recently specified substantial quantities of resorcinol to be used in gluing glider parts. There are also many other military uses for this type of resin glue, namely, the lamination of ship keels and bottoms, gluing of structural parts in Naval craft, and lamination of propeller stock. These requirements indicate that the demand is greater than the supply. Therefore, WPB has taken steps to allocate resorcinol adhesives.

For April all suppliers of resorcinol-formaldehyde resin glues were required to list their customers on form WPB 2947, and authorized allocations were made by WPB as soon as all these forms were in the hands of the Plastics Branch. An amendment to Order M-300, Schedule 87, has been issued which requires form WPB 2945 to be filled out by applicants desiring to use resorcinol adhesives. Manufacturers who are presently supplying a resorcinol type of adhesive containing phenol are already under allocation and do not have to use form WPB 2947.

Federal Communications Commission

In an impressive presentation before the Federal Communications Commission, Paul D. Zottu, Thermex Div., Girdler Corp., and William T. Cruse, executive vice-president, Society of the Plastics Industry, demonstrated both visually and orally the need of the plastics industry for a wide wave band in order to further the future growth of the plastics industry.

Despite the fact that Mr. Zottu was practically the last witness to be heard by the Commission in its hearing on the allocation of wave bands, there seemed to be little doubt that he held the interest and aroused the curiosity of the Commission as much or more than any of the various persons who appeared in behalf of their individual interests.

In emphasizing the necessity for one broad wave band and as many narrow channels as could be provided, Mr. Zottu called attention to various complicated electrical parts molded in compression presses and gave authentic figures to show how production time had been reduced by more than half in many cases. Among the samples he exhibited were several wartime applications. He pointed out that while it would be impossible to operate the high-frequency preheaters in current use in a narrow channel without causing interference, it would be fairly simple with a broad wave band. He indicated that the narrow bands requested could be used for special jobs and that special equipment with crystal control could be provided in these particular cases.

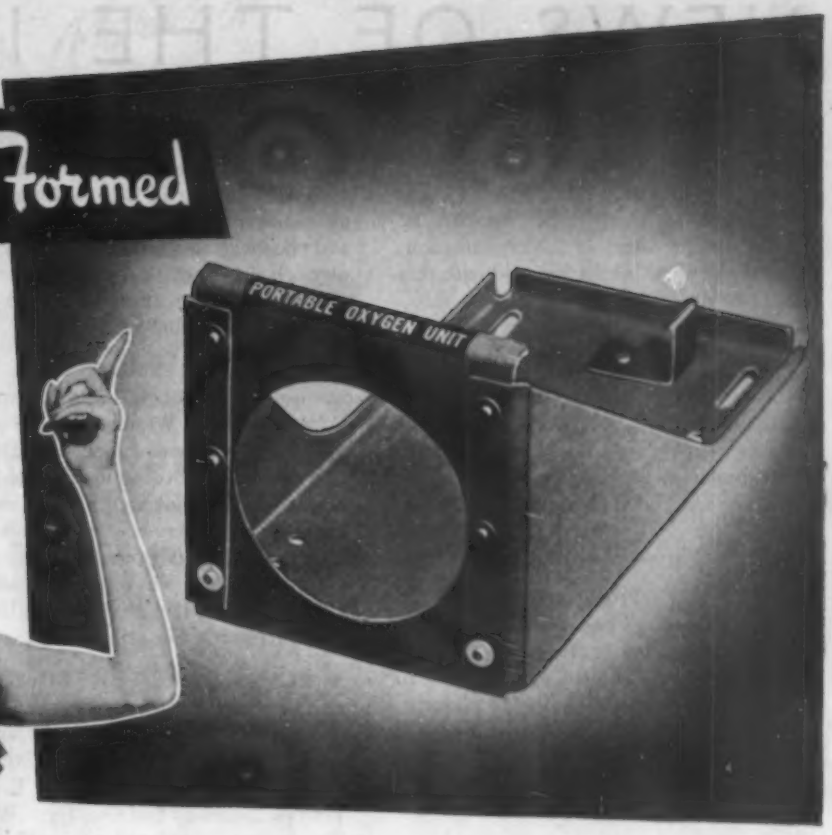
Mr. Cruse presented facts to indicate the size of the industry and the usefulness of the high-frequency preheaters. He said that between 50 to 60 molders out of a total of somewhere near 600 were using this equipment at present and many more would acquire it just as soon as the machines became available.

Mr. Alexander Senauke of New York, a consultant on industrial high-frequency heaters, also appeared before the Commission and, in addition to presenting an impressive brief on the use of these machines, answered technical questions concerning their applications and their method of operation.

The Chairman of the Commission promised that a technician would be sent to the various plants to study present conditions before a final decision on allocation of space was made. There was no indication of when a decision might be expected from the FCC, but inquiry from their office brought forth the answer that a final report may possibly be made as early as April.

(Please turn to page 202)

Beautifully Formed



Formed in a single operation

with Post-Formed Phenolite, this portable oxygen unit support used in B-29 Super-Fortresses illustrates a revolutionary new development in laminated plastics.

Post-Formed Phenolite*

Offers You New Possibilities for Profitable Post-War Products

Here, through a new development in laminated phenolic plastics, a whole new avenue of applications is opened for you . . . new potentialities for successful post-war products.

Economical to produce, Post-Formed Phenolite parts are made by heating the sheet material for a few seconds and forming in an inexpensive wooden mold with standard press equipment. In a matter of minutes, practically any shape or form may be obtained—without sanding or removing "flash." Fabrication may be done before or after the forming operation.

Phenolite is light in weight (about half the weight of aluminum) . . . is an excellent electrical insulator . . . has remarkable mechanical strength . . . possesses good machinability . . . and is highly resistant to moisture. This unusual combination of properties makes it a versatile material suggesting an almost endless number of industrial applications.

Now used almost exclusively for structural parts in aircraft—demonstrating its stability under varying atmospheric conditions—Post-Formed Phenolite is being supplied for important war purposes only. But, in it, you'll find countless possibilities for profitable peacetime products. Write today for further information and the assistance of one of our trained technical men in planning your post-war projects.

*A formable thermosetting sheet material

NATIONAL VULCANIZED FIBRE CO.

Offices in Principal Cities Wilmington, Delaware

NEWS OF THE INDUSTRY

★ FARREL-BIRMINGHAM CO., Ansonia, Conn., and Buffalo, N. Y., has announced the election of Franklin R. Hoadley as president of the organization. Mr. Hoadley has been associated with this company since 1914.

★ WORCESTER MOLDED PLASTICS Co., Worcester, Mass., has moved from its present location in the Osgood Bradley Building on Grafton St. to 14 Hygeia St., where it will occupy a five-story building. Employees of the company were recently awarded their fourth Army-Navy "E" award for unflagging efficiency of production for the war effort.

★ CONSTRUCTION WORK WILL BE started as soon as possible on a new research laboratory at Brecksville, Ohio, for the B. F. Goodrich Co., according to an announcement by John L. Collyer, company president. Additional demands upon the research division make it advisable to extend already overtaxed laboratory facilities.

★ MR. H. Z. BENTON HAS JOINED the engineering staff of American Phenolic Corp., Chicago, Ill., to assume charge of design and production of tube sockets for radio, radar, television and industrial uses. He will also supervise engineering and research on specialty antennas.

★ UNITED STATES PLYWOOD OF Canada, Ltd., has been formed as a wholly owned subsidiary of United States Plywood Corp., New York, N.Y., to acquire Hay and Co., Ltd., Woodstock, Ont. It will act as Hay's marketing agent and also conduct an independent business in adhesives and other materials not heretofore marketed in Canada. Some of these materials will be immediately available and others must await the end of the war.

★ MODERN PLASTICS CORP. OF Benton Harbor, Mich., have acquired a second molding plant which will now be known as Bangor Plastics, Inc. This plant will be devoted to the fabricating of timing gears as well as high- and low-pressure laminated fabrication.

★ IT IS WITH DEEP REGRET THAT we report the death of Louis C. Wolfson, general manager of Ideal Plastics Corp., Long Island City, N. Y. Mr. Wolfson, who died on March 8 at the Harkness Pavilion, Columbia Presbyterian Medical Center, after a prolonged illness, was in charge of the plastics division of Ideal for the past three years, and served as administrator and coordinator of the company's military contracts.

★ ROBERT H. KITTNER, FORMerly engineer with the American Hard Rubber Co., New York, N. Y., has joined the Glenn L. Martin Co., Baltimore, Md., as manager of its newly created plastics and chemicals division, and will have complete charge of the development program of Marvinol products, trade name of the new Martin elastoplastic.

★ AT THE FIFTH ANNUAL CONference of the Engineering Institute of Canada, held in Winnipeg, the Plummer Medal for 1944 was awarded to Dr. Wilfred Gallay of Ottawa for his paper on "Plastics in Engineering." The medal is awarded for papers on chemical and metallurgical subjects presented to the institute. Dr. Gallay was formerly head of the Colloid Chemistry Division of the National Research Council, Ottawa.

★ PLANS FOR THE CONSTRUCtion of a new plant, near Orange, Tex., to boost nylon production for military purposes, at the specific request of the Government, were announced by E. I. du Pont de Nemours and Co., Inc. Work on the project, estimated to cost approximately twenty million dollars, is to start immediately. The Texas plant is to be designated as the Sabine River Works.

★ THE FURANE PLASTICS AND Chemicals Co., has been organized, with offices and manufacturing plant at 5233 West San Fernando Rd., Los Angeles, Calif., to produce plastics materials and various chemicals derived from furfural. Initial production will be devoted to the preparation of high-strength, coldsetting adhesives for plastics and rubber products. John Delmonte, technical director of Plastics Industries Technical Institute, will act as consultant to the company.

★ AMERICAN CYANAMID CO., New York, N. Y., has announced the purchase for the Calco Chemical Div. of a factory site along the Ohio River near St. Marys, W. Va. Acquisition of this plant site will provide a location for the development of new products whose basic raw materials are available in the Ohio Valley trade center.

★ COMPLETION OF THE LARGEST and most advanced research laboratory ever created for the development of improved tires and other rubber and plastics products was announced by John W. Thomas, chairman of the Firestone Tire and Rubber Co., Akron, Ohio. The two million dollar laboratory, which is designed to open a new era in the rubber industry, will bring immediate acceleration of research into improved synthetic rubber for military tires, electronic vulcanization of rubber, lighter flak vests for airmen and dozens of other wartime projects.

★ DR. DONALD PRICE, WELL known for his research work on wetting agents, synthetic detergents, water repellents and sulfonated oils, has been appointed technical director of Oakite Products, Inc., New York. N. Y. Dr. Price will direct the activities of the engineering and chemical staff.

★ THE CAPITAL STOCK OF THE Youngstown Miller Co., Inc., Sandusky, Ohio, manufacturers of plastic coaters and oil reclaimers, has been purchased by Walter Kidde and Co., Inc. All operations will be transferred to 675 Main St., Belleville, N. J., where orders on hand will continue to be filled under the direction of F. L. Gerin, who becomes vice-president and general manager of the new unit.

★ A NEW CHAPTER OF THE SOCIety of Plastics Engineers, Inc., has been formed in Milwaukee, Wis., raising the present number of chapters in this organization to seven. Members of the board of directors are: A. D. Foote, Allis-Chalmers Co.; R. P. Geisler, A. Williams and J. M. Nash, Eclipse Molded Products Co.; G. Kroening, Chicago Die Mold and Mfg. Co.; H. R. Marshall, Cutler-Hammer Co.; P. R. Marvin, Milwaukee Gas Specialty Co.; W. F. Strutz, Chicago Molded Products Corp.; and S. P. Walsh, Formica-Insulating Company.

★ BECAUSE OF ITS EXPANDING activities in the manufacture of all types of plastic products, the Forest Industries Research Co., Tacoma, Wash., has changed its name to General Plastics Mfg. Co. There has been no change in ownership, management, personnel or location.

Sorry!

★ DUE TO A TYPOGRAPHICAL error on page 113 of the article "Varying silicone formulations" which appeared in the April issue, an erroneous impression was given of silicone rubber's ability to withstand ozone, corona and ultraviolet light without deteriorating. The sentence in question should have read: "In addition, this new material is unaffected by ozone, corona and ultraviolet light which act as deteriorants on natural and synthetic rubber."

★ IN THE 1945 ISSUE OF THE PLAStics Catalog, two photographs were shown in the chapter on cellulose acetate which properly belong in that on cellulose acetate butyrate. The transparent tubing of F. W. Dwyer Mfg. Co.'s manometer and the housing of Galvin Mfg. Corp.'s electric fence controller are of Tenite II.

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IC-3

Creep properties

(*Continued from page 154*) would lead to the estimate that about one-third as much reaction takes place during a long-time creep test as during molding.

An attempt was made to see whether the hyperbolic sine[6–8] or the logarithmic method would best express the relations between stress and creep rate of these materials at constant temperature. Figure 27 is a plot of creep rate in percent per 1000 hr. versus stress. The data were obtained from the "effect of stress" curves. It was found, tentatively, that the straight line relation of the log-log plot best expressed the relation between stress and creep rate for the mineral-filled materials but that the hyperbolic sine relation is better suited for the cellulose-filled materials.

Conclusions

1. The total creep in 1000 hr. and creep rate (in percent per 1000 hr.) depend to a considerable degree upon the type of filler used in molded phenolic plastics. The creep of materials containing inorganic fillers is much less than that of materials with organic fillers of the cellulose type.

2. Continued heating has tremendous effects on the creep properties of phenolic plastics. Extension due to load is largely compensated by contraction due to shrinkage. Cellulose-filled materials give evidence of a very extensive amount of shrinkage.

3. The long-time tensile strength at 192° F. varies roughly from 18 to 25 percent of the short-time tensile strength at room temperature, depending on the filler used.

4. Modulus of elasticity in tension increases 25 to 50 percent after continued heating at 192° F. for 1000 hr., depending upon the type of filler used.

5. The straight line relation of the log-log plot apparently best expresses the relation between stress and creep rate for the mineral-filled phenolics but the hyperbolic sine method is better suited as a simple method of expressing this relation for the cellulose-filled phenolics.

6. By using the technique presented in this paper, a more definite knowledge of the behavior of phenolics at high temperatures can be obtained.

Acknowledgment

The suggestions of Dr. Turner Alfrey on the interpretation of the shrink phenomena are greatly appreciated.

[6] A. Nadai, "The Influence of Time Upon Creep—the Hyperbolic Sine Creep Law," Stephen Timoshenko Anniversary Volume, Macmillan Co., N. Y. (1938).
[7] P. G. McVetty, "Creep of Metals at Elevated Temperatures—The Hyperbolic Sine Relation Between Stress and Creep Rate," Trans. A.S.M.E. 65 (Oct. 1943).
[8] A. Nadai and P. G. McVetty, "Hyperbolic Sine Chart for Estimating Working Stresses of Alloys at Elevated Temperatures," 46th Annual Meeting A.S.T.M., June 28–July 2, 1943.

Polyamide resins

(*Continued from page 126*) corrosion and any mild mechanical damage on overseas shipment, but which may be easily removed at its destination.

Miscellaneous applications

Package labels, printing inks, alkali-resistant coatings, adhesives, resin castings, sealing wax, batteries and chewing gum are a few examples of fields of potential usefulness for these materials. Polyamide resins are a new tool to the formulator. They possess a combination of properties which is not possessed by any other single material. Numerous specialty products are being developed from them which will solve many problems and command specialty prices. Polyamide resins give a new opportunity to the formulator of specialties both for war use and for the postwar period.

Forms available

The resins are commercially available in tonnage quantities in four forms:

General Mills polyamide resin—hot melt compounded ED-95 (ball and ring 95 to 100° C.).

General Mills polyamide resin—hot melt uncompounded ED-94 (ball and ring 105 to 110° C.).

General Mills polyamide resin—solvent type uncompounded ED-93 (ball and ring 105 to 110° C.).

General Mills polyamide resin—DET 201 (soft, balsamic, straw-colored, adhesive semi-solid).

Engraving of molds

(*Continued from page 145*) a 90° cone-shaped style is used with sunken "V" groove copy or master templet. This setup is shown in Fig. 13. 2) For cutting relief, or raised, letters and designs or for cutting sunken letters and letters from square bottom groove copy, a roller-tracer style (Fig. 14) is generally used. 3) For engraving in three dimensions on 3-dimensional machines, a round-nosed tracing style is used (Fig. 15). This type of arrangement allows the tracing style to move more freely over the model.

Hand engraving

On the average it takes approximately 15-years or more of experience to become a first-class hand engraver. Time and experience are needed to develop artistic ability and to translate this skill and knowledge into unerring movements.

The hand engraver needs very little equipment. Most of his tools—special punches, chisels and a large number of hand gravers of all shapes and sizes—he makes himself and with them achieves the striking effects for which hand engraving is noted. When these tools—always sharp and in perfect working condition—are used, the material is removed with a number of shallow cuts rather than with a deep chiseling action. To accomplish this, strong fingers are necessary since a pushing-type motion is used, the cutters being held at a certain angle to govern the depth of the cut that is being taken. Physical and mental fatigue, especially in the cutting of intricate shapes, often results in complete breakdowns if precautions are not taken.

The kinds of work best suited for hand engraving (Fig. 16) are cavities or master hobs where contour, size, shape and parting lines continuously change. When only one hob or cavity of irregular contour is required, it is generally more economical to engrave by hand rather than by machine, thus eliminating the necessity of making a master pattern. Examples of this would be the lucky charm and novelty shown in Fig. 17.

Conclusion

There are many times when mold parts are machine engraved when they should have been cut by hand, and hand engraved when they should be machined. For this reason, there are a number of variables that must be considered before a decision is reached as to whether a certain mold part should be hand or machine engraved. The number of parts to be

...and you ain't seen the half of it!
This is only the beginning of the story—the story of PLEXON, the plastic coated yarn. The full story can't be told till after the war is over. In the post-war days ahead, PLEXON will make an important contribution to textile and other industries.
PLEXON offers you the dramatic advantages of its plastic coating while still retaining the traditional qualities of its cotton or rayon base. Made in a full range of colors and in various finishes.
PLEXON yarns woven into fabrics are currently being used in the shoe, handbag, drapery and upholstery fields. They appear on smart tables as mats or to reinforce crystal wear. They make such diverse things as screens and suspenders.
This is the time to investigate PLEXON. We are in a position to supply small quantities of experimental PLEXON yarn to those manufacturers who are working on their post-war lines.
FREYDBERG BROS. STRAUSS
INCORPORATED
Plastics Division
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PLEXON
THE PLASTIC COATED YARN

engraved, the uniformity between parts, the quality required in the finished article, kind of steel being used and the availability of a skilled hand engraver or machine equipment, are a few of these factors.

In some instances a combination of both methods is the only satisfactory solution to the engraving problem. However, any shop that has even one man skilled at both hand and machine engraving is very fortunate. The example shown in Fig. 19 could either be machine engraved, hand engraved or engraved using a combination of both methods depending on the varying factors mentioned above.

When engraving problems arise, the services of a good, reliable engraving shop, equipped for both hand- and machine-types engraving, should be sought. It should always be borne in mind that good hand engravers are artists who are inclined at times to be temperamental. Because of this, working conditions should be of the best so that the skilled engraver may give his best to the job he is engraving and not be hampered or distracted by insufficient light, unnecessary noises and needless worries.

A letter home

(*Continued from page 127*) a mottled brown cellulose acetate using a mixture of H-2 and H-4 material to achieve the mottling. The holder is reinforced by adequate ribbing on the underside; and small pieces of felt are cemented to bosses on the four corners to permit the stand to be used on desks of any material without marring their surface polish or slipping.

The loose leaf calendar holder studs are made of extruded thermoplastic rods cut to length and bent to the required shape after a thread is cut on one of the ends. The unthreaded end is inserted in a well, or hollow boss, while a nut (also injection molded, and tapped out after molding) is used to hold the threaded end of the stud in position. The nut is screwed onto the stud from the underside of the calendar-pad holder after the calendar itself is in place. Pen or pencil grooves are also provided on either side of the calendar.

The blotter is an assembly of three injection molded pieces, the knob, the top and the rocker bottom. These parts together with the parts of the calendar pad are shown in Fig. 2. A male insert is molded in the rocker, while a mating insert is molded into the knob. The top is slightly cut away on the ends to allow a blotter to be inserted at either end. To install a blotter, the knob is loosened, and the blotter is pushed between the top and the rocker. When the knob is re-tightened the blotter is firmly gripped between these two parts. A felt is glued to the bottom of the rocker; and generous ribbing is used on the inside surfaces of all the parts. All moldings are buffed and polished before shipment.

After meeting the needs of Government procurement agencies, the molder plans to make this set generally available, manufactured in an extensive variety of both matching and contrasting colors.

Today many of these desk sets are actually within firing range of the enemy on many of our Navy ships. While they represent a minor detail in the complement of so complex a thing as a fighting ship, they exemplify the extent to which our Armed Services have investigated the possibilities of plastics and applied them to good advantage.

Credits—Material: Tenite. Injection molding by Ohio Plastics Co.; extrusion by Plastex Trim for Treasury Dept., Navy Dept. and other Government procurement agencies.

Synthetic fibers

(*Continued from page 158*)

Table X shows the behavior of the fibers on heating. Glass is, of course, incombustible, has a high softening point and considerable thermal stability. Polyamide, acetate, vinylidine chloride and vinyl resin fibers are thermoplastic. They vary in softening point, thermal stability and combustibility. The thermoplasticity of these fibers is a disadvantage for some uses but has been turned to good advantage in the production of textiles which do not crease readily or which hold a crease or pleat even when laundered.

The low moisture absorption of some of the fibers has been mentioned. Vinyl resin, vinylidene chloride and glass fibers hold 0.1 percent or less when saturated. Nylon holds about 7.6 percent. These fibers swell little or not at all in water, and they dry very rapidly. Casein and soybean protein fibers resemble wool in their moisture relations and the regenerated cellulose rayons are relatively absorptive. The absorption of moisture by fibers, from air of different relative humidities is shown in Fig. 1.

Some synthetics do not soil readily and are easily cleaned because of their inertness and smooth surface. The rayons, except acetate, dye very much like cotton. Acetate rayon and polyamide fibers, however, require special dyestuffs and handling. The synthetic protein fibers dye like wool. Vinyl resin, vinylidene chloride, and glass fibers can be dyed only with difficulty or not at all, but they can be colored by the addition of suitable pigments before extrusion and by a number of other means.

Future prospects

Whether a fiber is of natural growth, manufactured from natural cellulose or protein, or wholly synthetic is not important to the future of the industry. What the fiber will do is important—and that depends upon its properties. Price is also a determining factor, and there is a limit to the number of kinds of fibers that can be produced economically. Accordingly, we may expect to find a few kinds of fibers with outstanding properties serving most of our needs. In the future, new products better fitted to meet the increasingly exacting requirements of use will be created from the best of the natural and synthetic materials.

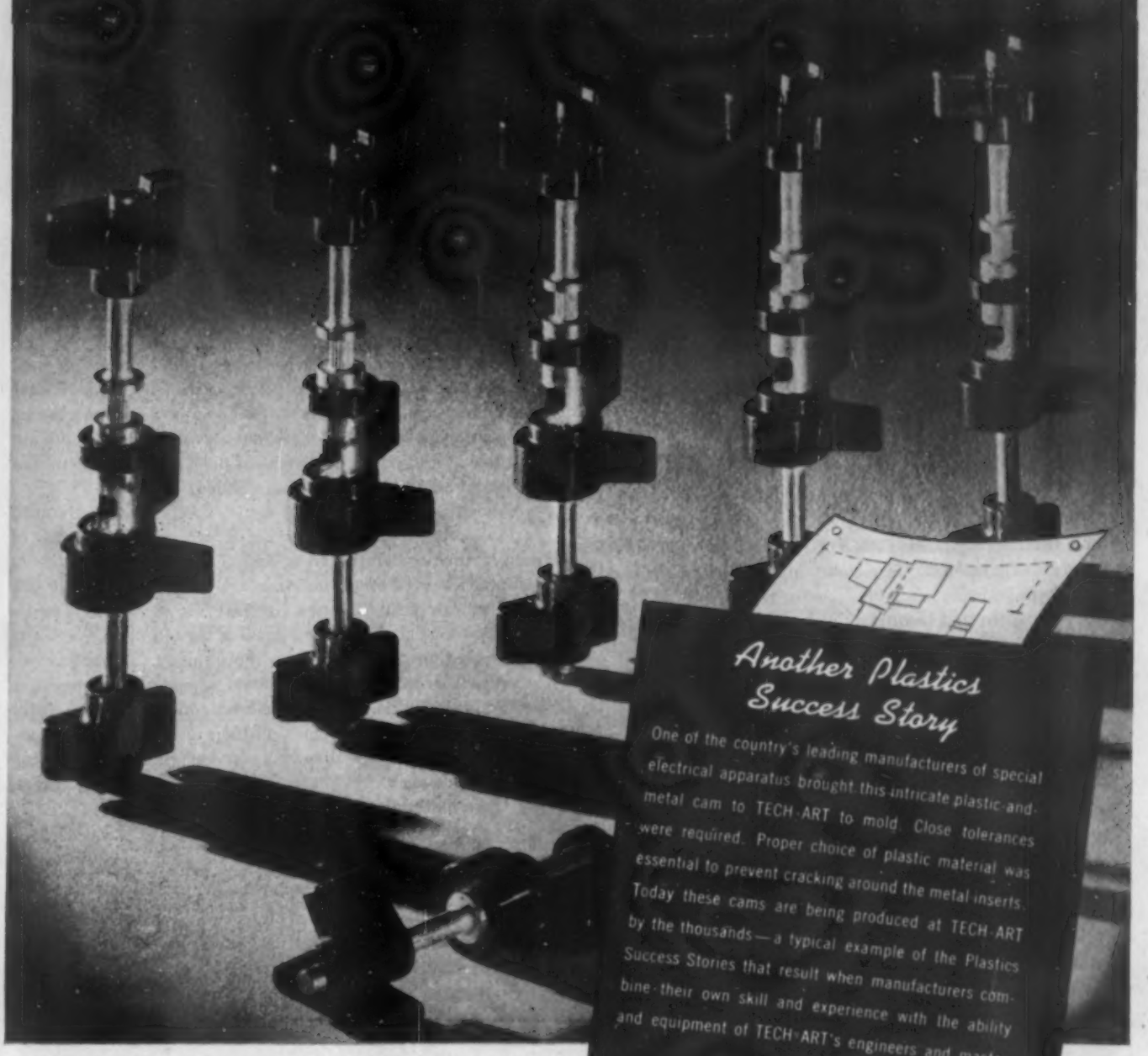
TABLE X.—EFFECT OF TEMPERATURE ON FIBERS

Fiber	*Loses strength above ° F.*	*Softens or melts above ° F.*	*Burning rate*
Glass	600	1500	Incombustible
Polyamide	435	470	Slow, melts slow
Rayon, acetate	200–220	445–400	
Vinylidene	170	280–240	Self-extinguishable
Vinyl, elastic	175[c]		Very slow
		356[a]	
Vinyl, regular	150[d]		Does not support combustion
		410[b]	
Casein	212	..	Very slow
Rayon,			
Viscose	300	..	Rapid
Cuprammonium	300	..	Rapid
Cotton	300	..	Rapid

[a] Becomes tacky at 240° F.
[b] Becomes tacky at 290° F.
[c] Elasticity is affected at this temperature.
[d] Shrinks at this temperature.

A Precision Idea . . . Molded in PLASTICS

Apart from sound product engineering, there is no single factor in the production of molded plastic parts that is so vital as precision-built molds. More and more, a realization of this fact is being evidenced by leading manufacturers who, in ever-increasing numbers, are bringing their precision ideas to TECH-ART to mold. Equipped with the most modern tool making facilities, TECH-ART's master mold builders look upon their work as an art—a precise art. TECH-ART's vast production facilities comprise all types of compression, compression transfer, automatic, semi-automatic and injection molding presses. TECH-ART's broad knowledge of plastic materials insures the proper choice of specific plastic compounds. Bring your plastic ideas to TECH-ART where precision-built molds are such a vital factor in producing so many TECH-ART Plastic Success Stories.



Another Plastics Success Story

One of the country's leading manufacturers of special electrical apparatus brought this intricate plastic-and-metal cam to TECH-ART to mold. Close tolerances were required. Proper choice of plastic material was essential to prevent cracking around the metal inserts. Today these cams are being produced at TECH-ART by the thousands—a typical example of the Plastics Success Stories that result when manufacturers combine their own skill and experience with the ability and equipment of TECH-ART's engineers and master mold builders.

TECHNICAL NOTES—These cams were molded from a melamine mineral-filled compound in high pressure, compression transfer molds. To eliminate critical stresses which might otherwise have been set up in the finished part, the materials were electronically preheated.

TECH-ART PLASTICS COMPANY

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SUCCESSORS TO BOONTON RUBBER MANUFACTURING COMPANY

PIONEER PLASTIC MOLDERS . . . Established 1891

Molded wood

(*Continued from page 104*) accommodated without subsequent remachining. This method should be used wherever possible because it is more economical in its use of resin.

Mold design

The research work done up to the present time by our company, particularly in relation to molding techniques, has drawn heavily from previous experience of the plastics industry in compression molding techniques and mold design. However, there are some points of departure from conventional mold design practice. Although, up to the present time, mold construction recommendations have centered largely around heat-treated tool-steel molds, recent experience has indicated that the use of cast brass molds may be satisfactorily used in production, if certain adaptations are made in mold design. In the final analysis, however, the total number of parts to be made will have a decided influence on materials for mold construction since the ultimate decision will have to be on an economic rather than a technical basis. While the use of non-ferrous molds for production purposes is largely precluded in conventional molding practice chiefly because of the pressure factor, they may be used in the molding of wood where a need for considerably lower molding pressures is involved.

Generally speaking, larger draft angles are required, because of the negligible lateral flow developed in a resin-wood preform. For the same reason, it cannot be expected that the preform will flow into recesses that would be quite normal for conventional materials.

While positive molds have been successfully used on several products developed to date, the flash type of mold (Fig. 5) has been found to be both less costly and very widely adaptable to wood molding. Again, it should be emphasized that, in common with conventional types of molds, no one type is suitable to all applications. Each product and its mold should be carefully engineered. Knockout or ejection pins should usually be provided.

The permanent and beautiful finish of a molded wood part is imparted during the molding cycle. The character of the surface finish is a replica of the mold surface. Hence, a polished chromium mold surface develops not only a far better surface finish on a molded wood part than could be imparted by the most painstaking hand method, but does so in a much shorter time.

Application

While the potential applications of molded wood appear to be very extensive, the approach to its use should be a conservative one. Up to the present time this technique has been successfully developed in this laboratory for use on such products as knife handles, toy parts, textile items, knobs, pot handles and other products. While these articles are generally small in size, there appears to be no reason why molded wood may not be equally successful for much larger units through the use of multiple preforms. This would indicate a potential use for furniture components, such as arm rests, high chair trays, caster wheels and table tops. In this connection, it may be mentioned that it is entirely feasible to integrally mold an impregnated veneer over a solid wood base. The use of molded wood in high quality table model radio cabinets appears to be a practical possibility.

The indiscriminate application of molded wood to products that can be readily molded of conventional materials should be definitely discouraged. But where it is important to have high strength, hardness, wear resistance and the natural beauty of wood, its use is indicated. It can also be used to great advantage where dimensional stability is required. One point not to be overlooked is that in woods such as ponderosa pine, poplar, willow and other relatively inexpensive woods, beauty comparable to many of the finest hardwoods can be readily obtained, particularly through the judicious use of dyes.

TABLE I.—PHENOLIC-WATER SOLUTION ABSORPTION FOR FOUR WOOD SPECIES

Wood	*Size*	*Oven dry weight*	*Impregnated weight*	*Molded weight*	*Resin content*
	in.	*g.*	*g.*	*g.*	*percent*
Hard Maple	1 × 6 × 6	436	680	485	10.1
Poplar	1 × 6 × 6	376	910	505	25.5
Ponderosa Pine	1 × 6 × 6	282	709	423.5	33.4
Birch	1 × 6 × 6	410	795	495.6	17.3

Solution concentration, 35 percent
Impregnating pressure, 200 p.s.i.
Impregnating time, 90 min.

Much has been said in recent years regarding the approaching obsolescence of wood in a world of synthetics: that very soon abundant light metals—magnesium and aluminum—would relegate wood to a background position. Nothing could be farther from the truth. The inherent properties of wood itself preclude such possibilities. It is true that new methods and materials often displace older ones. For example, there are many items now being made of plastic that are definite improvements over their wood predecessors. The same will be true of the light metals. This trend will continue as long as the properties of these substitute materials are better adapted to a use than is wood.

Molded wood must depend for its acceptance, in common with all other materials, on what it can offer in the way of performance under the wear and tear of use conditions in competition with other materials. It is not a substitute material in any sense. On the contrary, its use is based on inherent merit. It is another in the already impressive list of materials that are available to the designer for applications where neither wood nor plastic alone can meet the technical or economic demands. While much remains to be done in the study of resin-wood systems and their associated techniques, sufficient data have already been accumulated to intelligently guide the development of many potential applications for these materials.

Signs and sign making

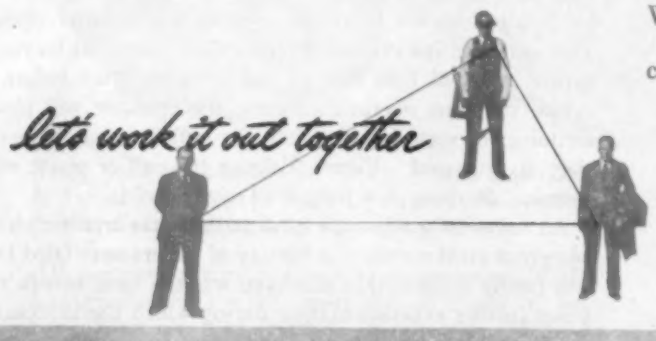
(*Continued from page 117*) new and distinctive lines by the graceful illuminated shapes of the enclosing plastic.

Another variation of this method—somewhat more limited in its usefulness—is to conceal the neon tube in a channel member which is riveted or bolted or crimped to the plastic letter as indicated in the sketch in Fig. 5. It is somewhat difficult to conceal the channel, and the light diffusion is not as complete as in the milled groove method where the tube is surrounded on three sides by the actual body material of letter. The expense of making and fitting the channel is greater, and the style of lettering somewhat limited by the shapes to which the channels may be formed.

Plastics for signs has long been an accomplished reality on a small scale, but the size of the letters shown in the accom-

Why a comb is big plastics news

Most of us take a comb more or less for granted. But to the plastics industry, *this* comb is different. Made of the No. 1 postwar plastic—Styron (Dow Polystyrene)—it is the "measuring stick" for plastics in respect to appearance, quality, price and moldability. There are a number of reasons for this leadership. First, Styron comes from the only privately owned synthetic styrene plant with sufficient facilities to care for molders' postwar requirements. This means availability—and it means an attractive price; add to these advantages Styron's long recognized superior physical properties, and the list of potential uses becomes almost unlimited. Why not find out how Styron fits into *your* postwar plans?



We at Dow know from experience that success in plastics is not a one-man nor even a one-industry job. It calls for the combined skill and cooperation of manufacturer or designer plus fabricator plus raw materials producer. Working together, this team saves time and money and puts plastics to work successfully. Call us—we'll do our part.

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PRESENT AND POTENTIAL USES—Lighting fixtures and displays; insulators; hydrometers; battery cases; funnels; bottles; closures; food handling equipment; pharmaceutical, cosmetic, and jewelry containers; jewelry; advertising items; refrigerator parts; pens; pencils; chemical apparatus; lenses; decorative objects and trim.

PROPERTIES AND ADVANTAGES—Beautiful, clear, translucent; "pipes" light through rod around corners, etc.; resistant to acids and many alkalies; stable at low temperatures; excellent electrical properties; broad color range; low specific gravity providing more moldings per pound; low water absorption.

STYRON

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DOW

PLASTICS

STYRON • ETHOCEL • ETHOCEL SHEETING
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panying illustrations will give the designer an idea of what can be accomplished with this material when it again becomes available for applications of this type. The novelty of the methods of applications is also a matter of interest, as they prove that in spite of drastic curtailments on materials for consumer applications, the spirit of invention persists. The dimensional stability of the acrylic plastics, their ability to resist moderate heat, their low water absorption and their rigidity, all point the way to many opportunities for their use in future signs and displays, both indoors and out.

Credits—Material: Lucite and Plexiglas. Signs by Designers of Industry.

Mass serving of foods

(*Continued from page 115*) ing properties of the plastic, Pyrex and paper from which the parts were constructed.

With this success behind it, the company decided to specialize in food products. Compartment and cafeteria trays were the next items to go on the market, and they represent the only instances in which the company followed a design that had already been established.

Handling problems bulk large in most establishments where these products are used. This is particularly true aboard ship, and when this company was requested to supply the Armed Services with coffee cups, it ignored established design and worked out a new cup that is specially suited for service in cramped quarters. As can be seen in Fig. 5, the cup has straight, slightly slanting sides and a wide border around the drinking edge which has a thicker wall than the rest of the cup. The handle, too, is changed—flattened at the top and lined up with the top of the cup body. By virtue of this design the cups nest one within the other. The wide edging keeps the cups from slipping too far inside each other and the bottom of the handle of the upper cup fits firmly and evenly against the top of the handle of the cup immediately below. With this construction there is no tottering tower of cups with handles slanting in all directions, that threatens to topple at the slightest excuse.

Even when filled, these cups can be stacked. The covers that are available for these dishes are grooved on the underside to fit the drinking edge. On the top is a raised section that matches the shape of the bottom of the cups. Thus, a cup may be filled with coffee, the cover put in position and another cup placed firmly on top of this cover. Only the problem of carrying too heavy a load limits the height to which these cups may be stacked.

The melamine serving dishes and covers are similarly designed—and for the same purpose. Hospitals, one of the big users of these dishes which come in half-pint, one-pint, one-quart, two-quart and four-quart sizes, are always crowded for space. Each shelf must be used with maximum efficiency, and the wide edging permits the dishes to be nested without fear of their becoming wedged together as they might if the outer walls were the same thickness throughout and a dish could slip almost completely inside another.

In at least one institution these covered dishes are used as servers. The food is dispensed in a central kitchen, dishes containing a full meal or a special order for a section of the hospital then being placed in a serving wagon and sent to the proper floor. There it is dished out, put on individual trays and delivered to the patient. So that food will remain hot during this period of transportation, the dishes are frequently preheated before they are filled. This is accomplished by placing the plastic containers upside down in a hot oven for a short period of time.

The melamine tumbler, creamer and the malted milk mixer cup, depart from the pattern of the coffee cups and food dishes. In these products V-shaped grooves on the outside walls take the place of the wide border. The bottom edge of the V rests on the pouring edge of the tumbler, creamer or mixer cup in which a similar product is being nested. This design also permits air purification and drainage.

The mixer cup has another unique feature. As can be seen in Fig. 3, four reverse triangle-shaped lugs are molded into these pieces on the inside surface. These raised sections fade away to nothing at the bottom of the cup and are scientifically designed to throw the liquid that is being mixed toward the bottom. If it were not for these lugs, the mixture would have a tendency to fly upward during the mixing process.

The field which these food products serve is most exacting. Food containers, in addition to being odorless and tasteless, must be easy to clean since there is no time for polishing and excessive scrubbing. And they must be sturdy, for institutions cannot handle kitchen and table ware with the care they usually enjoy in homes. Under these conditions all the products have turned in a satisfactory performance record and have, in many instances, reduced breakage costs.

Credits—Material: Melmac and Durez. Two-gallon food container molded by Richardson Co. Individual container, Eclipse Molded Products Co. One-pint food dish with cover, coffee cup with handle, coffee cup without handle, coffee-cup saucer, coffee-cup cover, Transmatic Co. Mixer cup, tumbler, creamer, Northeastern Molding Co. Cafeteria tray, compartment tray, gallon capacity food dish with cover, half-gallon dish with cover, quart dish with cover, Molded Products Co. Paper gaskets, Southerland Paper Co. Paper covers, Keys Fibre Co. All products produced for Devine Foods, Inc.

Frangible bullet

(*Continued from page 135*) bullet slugs. In this photograph the slugs are held suspended by their gates. As the press motion continues, the bolster plate containing the transfer pot and sprues moves away from the transfer plunger. This action strips the bullets from their gates but leaves the sprues and cull held fast on the plunger. Just before the actual stripping operation occurs, the operator will place a container of some type beneath the bullets to catch them as they are stripped. Figure 9 shows the cull or waste which remains after one shot from a 49-cavity mold.

An undercut wedge-type sprue puller in the transfer plunger has given good results. A variety of pullers were tried but it was finally decided that this type was the most satisfactory. Upon further experimentation during which the thickness of the sprue plate was altered, the type of sprue puller changed and the area of the cull per bullet reduced, the waste was reduced from 872 grams per 49 slugs to 143 grams.

Figure 10 shows the results of experimental work along these same lines at a third molder's plant. This new mold was of hexagonal pattern with 61 cavities. The reduced area of the transfer pot as well as the reduced center-to-center distance of the cavities resulted in an increased yield—from approximately 18 to 23 bullets per lb. to 40 bullets per pound. Previously, over two-thirds of the material had been wasted in each shot. The truth of this statement is borne out by a comparison of the two culls shown in Fig. 10, the lefthand piece showing the size of the cull before reduction, and the right-hand piece, after the change. *(Please turn to page 200)*

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As a result of these improved designs, when all the molding plants have adopted the new pattern, the Ordnance Department and the plastics industry will be able to effect a material saving of approximately $370,000 per month and will conserve virgin lead to the extent of 605,000 lb. per month. The lead that is saved will naturally be made available to other critical programs. In addition, there will be a decided saving in strategic phenolic resin and in the manpower requirements of companies powdering lead and producing molding material.

Another company elected to develop a molding technique that did not require the use of preforms. Material handling, however, proved to be quite a problem. The company soon discovered that the normal 3½-gal. material pail which weighs 20 lb. when filled with ordinary molding material, weighs 125 lb. when filled with this lead mix. The same problem also extended to the weight of the barrel of culls. A barrel filled with the normal type of scrap can be handled very easily by one man. But with the lead-filled phenolic, two and sometimes three men were needed to move the scrap, and the expected production of this plant was such that 6000 lb. of this lead mixture had to be handled every day. Inasmuch as all the husky boys have gone to war, the molder had only older men and girls for the handling.

Figure 11 shows a unique and definitely "homemade" system for automatically getting the material out of the shipping cans, accurately weighing a predetermined amount and depositing it in the leading fixture. A special pulley and cable arrangement, not seen in this photograph, raises the material can into position over the hopper of this machine so that at no time need one of the operators manhandle such a heavy load. Moving the lever that is held in the left hand of the operator (as shown in this photograph) approximately 60 degrees, is sufficient to fill the loading fixture with the correct amount of material for one shot. Figure 12 shows this loaded fixture ready to be placed in position over the transfer pot. Before releasing the material into the pot, however, the mold is closed. The shot of bullets from the circular mold is shown in Fig. 13 just after it has been withdrawn from the cavities. After the bullets have been stripped, the bolster plate continues to drop away from the transfer plunger, leaving the cull as before. Figure 14 shows the cull which remains after the molding operation of this circular mold.

In all of the molding plants, the molders make a careful visual inspection of the bullet slugs as the molding operations proceed. In this way any obvious mold or molding defects which may arise can be detected before too many rejects pile up. In addition, all companies have a final inspection.

A rather unique inspection machine is pictured in Fig. 15. This piece of equipment will handle many sizes and shapes of small objects—buttons, collapsible tube caps, bottle caps and, in this case, bullet slugs. When handled on this machine, the parts are given a dual inspection, for they pass first on a moving belt before the operator at the left, then are transferred to a second belt moving in the opposite direction and pass before the operator at the right. An additional feature incorporated on this machine is two scraper bars which can be seen mounted just above the belt and in front of each operator. These bars, at an angle to the belt proper, serve to agitate and roll the bullet slugs. This permits the operator to inspect a great deal more of the surface than would be possible if the parts remained in one position on the belt. It also eliminates the necessity of the operator's handling the bullets as they pass before her eyes except for removing any rejects. Note the excellent lighting which is available for this inspection.

The hopper and delivery system is very simple. The delivery pipe or tube projecting from the lefthand side of the hopper is arranged so that it rotates at all times when the machine is in operation. The angle at which this pipe rests can be varied up or down by merely turning the lever, thereby controlling the speed with which the parts to be inspected are deposited on the first moving belt. Simple and effective, this machine will probably find much wider use once the molding industry becomes more familiar with its many and varied uses.

As a further assurance of absolute quality control of these parts, many companies not only insist upon the molders' inspection and a so-called final visual inspection, but they also spot check each batch of bullet slugs with a 100 percent micrometer inspection on all dimensions. If more than ½ of 1 percent of these parts are found to be outside the tolerances permitted, the entire batch of bullets is withdrawn from shipment. Some molders pass each bullet through sizing dies.

No mention of finishing operations has been made for a very obvious reason—the molder is not required to perform them. This is because the cartridge manufacturer removes the gate when he cuts the crimping groove and end radius.

At the beginning of the program all plastic molders and manufacturers of lead powder were properly warned of the possibility of lead poisoning or lead intoxication that might injure employees in the handling of the lead powder or lead mix. All of the molders and manufacturers of mixed and powdered lead had available to them the findings of the National Association of Lead Powder Mfrs., the National Lead Mfrs. Assoc., and State Health Departments.

In the case of most of the molders, suitable installations for reducing hazards from lead powder involve the isolating of the frangible bullet presses from other presses, and the installation of efficient exhausting systems with outlets for the air in such areas as the transfer pot on the mold in the machines and in the powder loading areas where the dust is created. There is nothing spectacular or unusual in the design of such exhaust systems. They are identical to similar systems for exhausting air in other industrial operations.

The critical accumulation of lead powder is 15 milligrams in each 10 cu. ft. of air, and it is mandatory that the concentration be kept well below this figure. In addition to the recommendations on exhaust systems, all molders and powder manufacturers were cautioned to furnish masks for all employees handling or coming in contact with the powder and to see that these employees used the masks. Much more elaborate exhaust systems are in use at the plants of lead powder manufacturers.

Acknowledgments

This story was prepared from information supplied by the Ammunition Branch, Small Arms Div., Office of the Chief of Ordnance, Army Service Forces; Shaw Insulator Co.; Boonton Molding Co.; Newark Die Co.; Industrial Hard Chromium Co.

Credits—Phenolic lead molding compound, Bakelite.

Rate of rise

(Continued from page 124)

A laminate, consisting of layers of oriented cotton fibers that have been treated in a continuous sheet with a phenolic resin, was the material selected for the molding of the two parts of the diaphragm case. These sheets, 0.002 in. in thickness, are cut into pieces 3 ft. long which are then plied. Each ply is laid at a 90° angle to the one below. These laid-up

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1. Type of molding material—manufacturer, name, number, and filler (if any).
2. Method of molding at present—compression or transfer.
3. Dimensions of preform; please include sketch.
4. If the shape of your preforms is irregular, do you know of any reason why it cannot be altered for more efficient application of electronic heat? (With electronic heating, vastly improved material-flow properties result; consequently, highly irregular preform shapes are probably unnecessary).
5. Weight of preform: .....lb. .....oz.
6. Number of preforms per charge.
7. How many presses are now used for this job?
8. What is present press cycle? Closing time .....seconds; curing time ..... seconds; number of cycles per hour .....
9. Temperature rise required: From .....°F to .....°F.
10. Present method of preheating (if any).
11. Description and significant details of molded piece.
12. Power supply available—voltage and frequency.
13. What priority can be extended?
14. Please describe any special problems you encounter.

Answers to these questions supplied to RCA will be held in strict confidence. Information of this type will help our engineers give you a quick reply.

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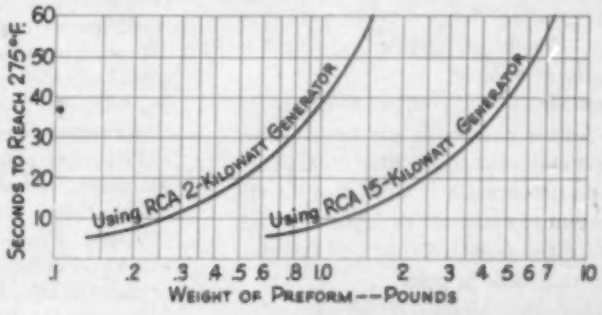

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panels are preformed under pressure, the preforming plates being heated to a temperature that will just soften the resin. This treatment serves to reduce the bulk factor and produces a laminated sheet that can be handled readily.

Blanks approximately the size and shape of the mold cavity are cut from the sheets and the load carefully weighed—enough cuts being used to produce the proper mold load. These blanks are then loaded into the mold cavity by piling one on top of the other. Both parts are molded under relatively high molding pressures in a flash-type compression mold. An ordinary hydraulic press, hand operated, is used for this job. The properties of the material are such that, even though it is cross-plied, it travels down into the depressions in the mold and fills all bosses and other projections. The flash is removed with a special contoured tool set up in a drill press and all specified holes are jig drilled.

Credits—Material: Avtex. Molded by Hood Rubber Co. for "Automatic" Sprinkler Corp. of America.

A redesigned compass

(Continued from page 111) fications on this instrument require the assembled compass to function properly after the unit has been vacuum tested in 9 in. of mercury for two hours and after it has been subjected to wide extremes of temperature—ranging from −60° to −160° F.—for a like period of time. Vibration tests must also be passed before a unit is approved for use in any military vehicle.

At present, a limited number of M-6 compasses are being offered for sale to civilians for use in aircraft and small boats. Soon a small compact automobile compass will also be available to the public. Like its predecessor it will be of an all-plastic design and will incorporate many of the features which make the M-6 so desirable. It is expected that this automobile instrument will be unusually low in price.

Credits—Material: Tenite II, Lumarith X and Plexiglas. Molded by Michigan Molded Plastics, Inc., for Sherrill Research Corp.

Washington round-up

(Continued from page 188)

Plasticizers and the demand

Difficult as the plasticizer situation is today, chances are that the difficulties will multiply before the war is over. Furthermore, officials predict that cessation of the European war may not ease the plasticizer situation to any great extent.

Before World War II, plastics processors paid little attention to plasticizer availability. It was something for the materials manufacturers to think about, but molders gave it little thought because it was merely part of the material which they were using and few of them were conscious of the complexities involved or of the sources from whence plasticizers were derived. But if there is a thermoplastic molder or processor today who is not conscious of plasticizer troubles, he is indeed an unusual person.

Vinyl and cellulose acetate are the two plastics most affected. The acetate situation has been severely handicapped by a plasticizer shortage for many months. Acetate sheeting in particular has been hard hit because apparently no one has found a substitute for phthalate which will work successfully in sheeting. When the chemical allocations were announced a few months ago, it was noted that several thousand pounds of sheet had been allowed for such things as identification cards and blueprint covers in war plants, provided no phthalate was used. A recent check indicates that that material was never delivered.

The vinyl situation, which was expected to be in fairly good shape by this time, threatens to become steadily worse because of a lack of plasticizer. Although new facilities with considerably increased production for vinyl chloride resin are about to come in, there seems little likelihood at the present moment that there will be anywhere near enough plasticizer for use with the resin.

The principal plasticizers involved are phosphate and phthalate, which are primarily derived from the coal coking process. The phosphate plasticizers, tricresyl and triphenyl, are derived from cresol and phenol, respectively. The phthalate plasticizers are derived from phthalic anhydride, which comes from naphthalene, another coke by-product.

Availability of these coke oven by-products has been seriously handicapped by the transportation evils that beset the country this winter, by a poor grade of coal which results in a smaller amount of by-products and by an attempt to speed up the coking process which has cut down the by-product supply.

There is no chance of increasing production by increasing the number of coke ovens because coal is coked primarily for steel, and if the steel industry has enough coke no one is going to build additional facilities for production of such things as coal-tar acids and naphthalene.

Tricresyl phosphate from cresylic acid is a plasticizer which is almost indispensable to the vinyl chloride industry. Yet it was allocated for March delivery on a 100 percent basis for civilian cellophane where it was used as a substitute for phthalate in the heat-sealing or moisture-proofing film which is laminated with cellophane. Only 35 percent of cellophane production is used for civilian purposes. Practically all of this is consumed in food and drug wrapping. Another fair-sized quantity went to air filters, which are used for reconditioning purposes in plants making delicate war items such as gyroscopes where reconditioning was absolutely necessary, and in place of oil which formerly produced a fire hazard. That was all the civilian trade obtained, except a tiny amount for one percent of civilian requests for miscellaneous.

Triphenyl phosphate, derived from phenol, was used as a plasticizer for acetate and particularly as a substitute for phthalate plasticizer. No civilian uses were permitted.

The most widely publicized plasticizer shortage has been diethyl and dimethyl phthalate, along with the other derivatives of phthalic anhydride for which there is wide usage in the thermoplastic field. Production of phthalic anhydride, which is derived from naphthalene, another coke oven by-product, was sharply increased to approximately 140 million lb. in 1944 and additional facilities are still in the process of building. A year ago, producers of phthalic anhydride complained about increasing production for fear there would be too much postwar phthalic anhydride capacity, and the Government was forced to bring in new producers to meet increasing military demands. Today there is scarcely any more naphthalene from coke ovens available for expansion purposes, but good progress has been made in a process that will bring in fair quantities of naphthalene from ortho-xylene, a petroleum product. This new program is expected to be well under way in a short time and thus provide additional quantities of the raw material from which phthalic anhydride can be produced.

Phthalic anhydride and its derivatives are used extensively as plastics plasticizers (vinyl and acetate). They are also employed in great quantities in alkyd resins for protective coatings. Ever-increasing quantities are needed as an insect repellent and in smokeless powder; dyestuffs require 14 million lb. a year. It is also used as a preservative for foods and drugs, as an oil demulsifying agent and in the manufacture of synthetic rubber.

Perhaps the most sensational application of a phthalic anhydride derivative is the dimethyl phthalate insect repellent which is rubbed on the skin. Diethyl phthalate is used to saturate clothing to prevent insect infestation with resultant protection against such diseases as typhus, malaria and elephantiasis. No one is going to argue about giving the Armed Forces all they need for this particular purpose and they will continue to need it in increasing quantities as the war in the Pacific continues to require more men.

The Navy has also publicized the remarkable qualities of alkyd

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resin coatings, containing phthalates, which prevent barnacles from forming on ship bottoms and thus keep them out of dry-dock. Similar protective coatings have helped to speed up assembly line production of agricultural implements and have been highly satisfactory in electrical insulation.

It should be noted that practically no civilian requests for phthalate plasticizers have been allowed in the last two months' allocations.

An indication of how the phthalic anhydride shortage is affecting industries other than plastics was revealed in a recent government press release when the Dyestuff Manufacturers Industry Advisory Committee attempted to show the Army how it could save phthalic anhydride by reducing its fabric shades and relaxing its fastness specifications. The same committee pointed out that its April allocation was only 980,000 lb., designated solely for military uses, while their average consumption should be more than 1,000,000 pounds.

Other Government releases have been coming out almost regularly pertaining to the low supply of phthalic alkyd resins and an amendment to the alkyd resin allocation order will require users of some coatings to use semi-alkyds or coatings without alkyds if they have baking facilities. In addition to other restrictions, the order compels reduction of inventories to approximately a fifteen-day level.

It seems almost certain that this plasticizer shortage will continue to plague the plastics industry until the end of the Pacific war. There has been some criticism because the Government has permitted an unbalance such as the increased production of new vinyl resins without sufficient plasticizer to process them, but it is doubtful that anyone but an almost pluperfect coordinator in the Government could have foreseen the Army's constantly increasing demands for smokeless powder and insect repellents in particular.

Selective Service

Resin manufacturers and plastics manufacturers who have elected to use the War Production Board as their claimant agency for draft deferments are confronted with a slight delay in the processing of their transmittal slips. Therefore, the WPB in Washington has not as yet received all of the transmittal slips from such companies. It was estimated, as of the early part of April, that about 50 percent of the transmittal slips on data for draft certification had been received and passed on to the branch chiefs for their recommendation. It is reported that these transmittal slips are being handled as rapidly as possible in the various branches in the Chemicals Bureau.

An exception to the 15 percent quota in the district level has now been made by a telegram which was sent March 26 to the WPB district managers. According to this exception, one man out of a total list of three, or two men on a list of from four through seven, may be certified by the district offices without being counted as more than 15 percent. This authority is retroactive, and it has been suggested that district managers reconsider and certify meritorious cases which were not certified previously because of the over-all percent limitation. Lists which have already been sent in with seven names or less will be processed in Washington with due consideration to this small list procedure.

If employers have men ordered to report for induction within the next few days, and if such men are so high up on the list that they will probably be included in the recommendation from Washington, it may be suggested that the employer approach the district WPB office to arrange for temporary postponement of induction. In such cases the district offices will often be able to do this through the WPB State Representatives for Selective Service.

Off-grade polystyrene

Because of the necessity for tightening up on benzol, a basic product necessary for polystyrene, and the necessity for using polystyrene only for most essential uses, WPB officials have requested and received cooperation from the industry:

1. To use fines in the compounding of colors suitable to allocation to most highly important uses.
2. To conserve other types of off-grade material, which may be off-color, off-molecular weight or dirty. In the past, these grades were released for miscellaneous uses under paragraph (f). It has been determined that these substandard materials are entirely suitable for many civilian items such as toilet tank floats, film spools and items of highest essentiality where they can be of greater service than when utilized for combs, cosmetic items, and so forth.

Under the old system, all off-grade polystyrene, including fines, was placed under paragraph (f) and producers distributed it as they saw fit. Some of it went for less essential items. Many civilian uses of reasonably good essentiality received allocations of prime polystyrene. The revised system does not provide prime polystyrene for many civilian uses which were formerly covered and it is now necessary to utilize off-grade material for those uses. For example, polystyrene was formerly allocated for toilet floats but from now on material for this particular use will be obtainable only under paragraph (f).

Synthetic rubber on military tires

A saving of 3000 long tons of natural rubber a year will result from Amendment 5 to Rubber Order R-1 issued April 3, according to the estimates of the Rubber Bureau of the War Production Board. Amendment 5, revising List 24, specifies construction changes involving the use of more synthetic and less natural rubber for the manufacture of the following heavy-duty tires for military procurement:

1. Low platform trailers
2. 10.00 cross-section, mud-snow
3. 14.00 2-ply highway, mud-snow
4. 8.00 to 16.00 combat
5. Earthmovers, 8.25 to 18.00

After severe tests, the Army and Navy agreed to the changes in specifications set forth in the amendment. As a typical example of how far the use of synthetic in place of natural rubber has gone, the 10.00 cross-section, mud-snow tire will now be made with 90 percent synthetic rubber as compared with 70 percent used prior to the issuance of the Amendment.

Urea and melamine aldehyde resins

In a move to curb inflated requests for urea and melamine aldehyde resins, which are in short supply, the WPB has announced that it will make a check on all consumers' proposed use of the material as well as on past use and present inventories.

This check will be made by requiring consumers to apply for the resins on Form WPB-2945 instead of filing purchase order certificates of proposed use. Moreover, through the use of Form WPB-2945 the agency said it will be able to keep track of consumers ordering the resins from several different suppliers. The new procedure will also reduce the considerable amount of correspondence now necessary to explain to consumers and suppliers what has happened to their requests for allocations, WPB said. This action was taken through an amendment to Schedule 34 (Urea and Melamine Aldehyde Resins) to M-300.

Wire for the Army

The following paragraph in a Government press release quotes Mr. Hiland G. Batcheller, Chief of Operations of the War Production Board, as follows: "We shall produce 155,000 miles of field wire (W-110B) in March, and the new equipment needed to reach the scheduled peak production of 200,000 miles a month is being delivered as expected. About 10 percent of that peak will be substitute wire, with plastic instead of braid covering, but the 180,000 mile remainder will be slightly above the 179,000 miles monthly issue requirement (excluding what is needed to make up deficiencies in stocks)."

Mr. Batcheller's use of the word "substitute" will no doubt be very interesting to all producers of plastic wire coating.

Northrop Aircraft's Black Widow P-61 night fighter, largest pursuit plane in the world, carries a sting that can blast out of the sky anything that flies. Fast, deadly and different, she maneuvers easily, lands at a remarkably low speed for her size and weight. She has the heaviest fighter plane armament in the world. With a crew of two or three men, she is being successfully used on many fronts. Although built to stalk and sting the enemy by night, she does an equally effective job in daylight combat.

Victory First . . . then, the pursuits of peace. To speed victory buy War Bonds and let your money keep the weapons moving to the front. Our boys will do the rest. Remember: War Bonds are the best investment in the future of our country . . . your stake in victory.

Virginia-Lincoln's modern plastic "Valinite" flies with the deadly Black Widow on her missions — her streamlined fuselage nose being fabricated of "Valinite". Naturally, we are proud of the magnificent success of this plane, and the part "Valinite" plays in her makeup. Our consultants will be glad to explain the many advantages of "Valinite" for peacetime uses.

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Hardesty Dibutyl Sebacate is recommended as a plasticizer for the vinyl copolymers, polyvinylchloride, polyvinyl butyral, nitrocellulose, cellulose acetobutyrate, acrylic resins and synthetic rubber. It is widely used with the vinyl resins, particularly in those applications where extreme low temperature flexibility is required. Dibutyl Sebacate has high plasticizing strength, evidenced by the amount required to produce a given flexibility, as compared to other plasticizers. It is tasteless, has no residual odor and stocks plasticized with Dibutyl Sebacate are characterized by low durometer hardness. Dibutyl Sebacate is resistant to yellowing on long exposure to light and is compatible with most synthetic resins and elastomers used in coatings.

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Copper	None
Iron	0.3 ppm maximum
Butanol	0.1% maximum
Flash Point	380°F.
Fire Point	420°F.
Boiling Point	344°C. at 760 mm. 175–180°C. at 3 mm.
Water Solubility	Less than 1% at 25°C.
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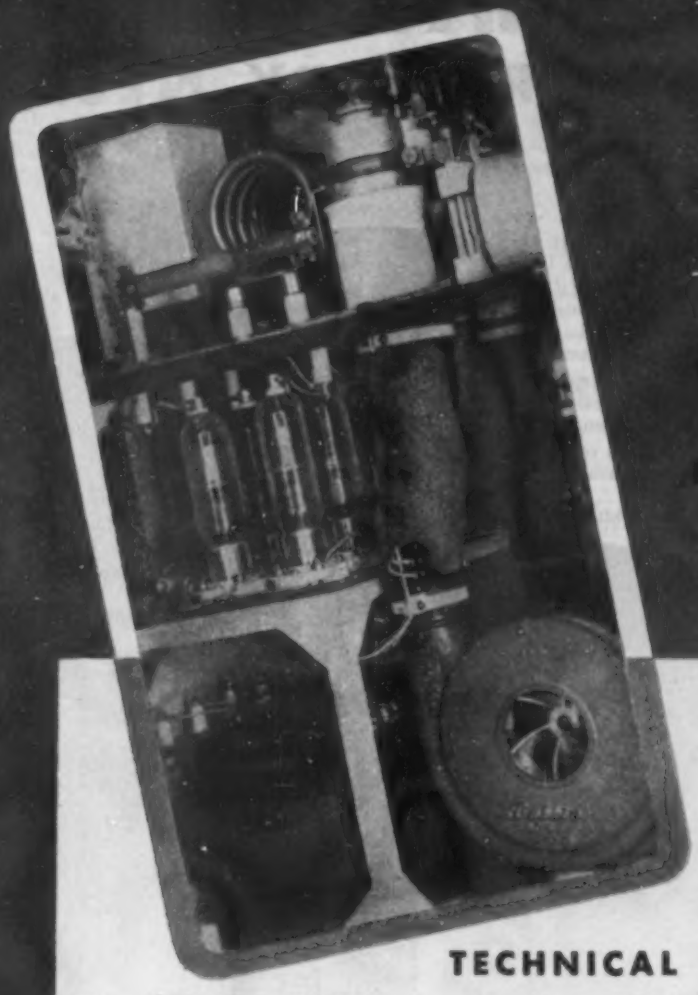


THE NEW

Thermatron

"HEATMASTER"

ELECTRONIC DIELECTRIC HEAT GENERATOR

5 KW OUTPUT*

Will heat a 5 pound preform in 90 seconds—occupies less floor space than many generators of one-half its power—uses new type long life radial fin tubes—operates automatically.

TECHNICAL DATA

OUTPUT—5 KW plus.

INPUT—8 KVA (approximate).

LINE VOLTAGE—220 volt, 60 cycle, 3 phase.

FREQUENCY—30 mc. — 15 mc., 5 mc. optional.

HEAT OUTPUT — Up to 17,000 BTU's per hour.

OUTPUT CIRCUIT—Permits heating of loads of widely varying characteristics with a minimum amount of adjustment.

TUBES—New long-life external anode tubes.

SIZE—24" wide; 28" deep; 59" high.

WEIGHT—Approximately 1000 lbs.

Completely self-contained, ready-to-use. A compact power-packed model, particularly designed for heavy-duty preheating in the plastic molding industry where floor space is at a premium. Will heat a 3.3 pound preform in one minute or a 5 pound preform in 90 seconds. Its generous capacity also makes it suitable for rugged general purpose production use as well as research requirements involving substantial power.

Complete specifications of the new **THERMATRON** "Heatmaster" and other standard models from 500 watts to 30 kilowatts contained in our new circular sent on request. Custom equipment up to 125 KW designed and built.

**All Thermatrons rated on output*

Thermatron Division

RADIO RECEPTOR COMPANY, Inc.

251 WEST 19th STREET NEW YORK 11, N. Y.

Engineers and Manufacturers of Airway and Airport Radio Equipment

SINCE 1922 IN RADIO AND ELECTRONICS

MOLD AUTOMATICALLY

A STOKES PRESS FOR EVERY NEED

Completely Automatic Molding — on Stokes Presses — is the acknowledged, *most economical* method for producing thousands of different plastics parts.

Automatic Molding saves molding labor . . . one man operates a battery of presses. It saves time and material . . . cycles are greatly reduced through split-second timing and flash losses reduced 8% to 10% or more.

Mold cost is low because a few cavities are used to do the work of many. Product changes can be made quickly and economically because molds can be made in a fraction of the usual time and at minimum cost.

Output is high . . . up to 10,000 or more moldings per week per cavity. Parts are produced as needed, reducing excessive inventories. Parts are of highest quality . . . there are no human errors to contend with.

For your present or post-war parts, consider the advantages of Automatic Molding with Stokes Presses. Write for full information now.

F. J. STOKES MACHINE CO. 5934 Tabor Rd. Phila. 20, Pa.

STOKES 15-TON COMPLETELY AUTOMATIC MOLDING MACHINE — the machine that established Automatic Molding as sound, economical practice. Hundreds are in service making thousands of different molded pieces. Complete, self-contained unit, electrically powered and heated.

STOKES 50-TON HYDRAULIC COMPLETELY AUTOMATIC MOLDING MACHINE for larger pieces and more pieces. Features same patented controls as the 15-ton press—Automatic Cycle Controller, and Super-Sensitive Trap that checks every piece made and literally "runs the press" . . . the only proved and foolproof method of operating a Completely Automatic machine. Only 2 hp. motor required to develop full 50 tons press capacity. High-speed operation with controlled closing speed.

50th year of Service to Industry

F.J.Stokes MOLDING EQUIPMENT FJS EST. 1895

DOUBLE SPEED SMOOTH AND EASY with DoALL Zephyr

CUTTING NON-FERROUS METALS PLASTICS, RUBBER, WOOD . . . .

Here's a machine every operator likes. Its performance is an attention holder every minute. Its speed is a real challenge—there's no waiting for the Zephyr to catch up. It travels just as fast as he cares to make it go, up to 12,000 r.p.m.

The 3,300 pounds of weight make the DoALL Zephyr practically vibrationless when cutting the tough new metals, alloys and laminates used today for war production and in the future for civilian needs.

Your output can be doubled without extra effort. It's just a matter of increasing the speed and guiding the work.

Want to see it work? Phone your DoALL man for a demonstration in your own plant, or write us.

Angle Cutting

Because of the 36" throat and tilting worktable, true angles are cut in 20% to 50% less time than by cut-off methods.

Send for Circular

Learn something about the remarkable performance of the DoALL Zephyr from our latest illustrated circular.

DoALL

INDUSTRY'S NEW SET OF TOOLS

CONTINENTAL MACHINES, INC.

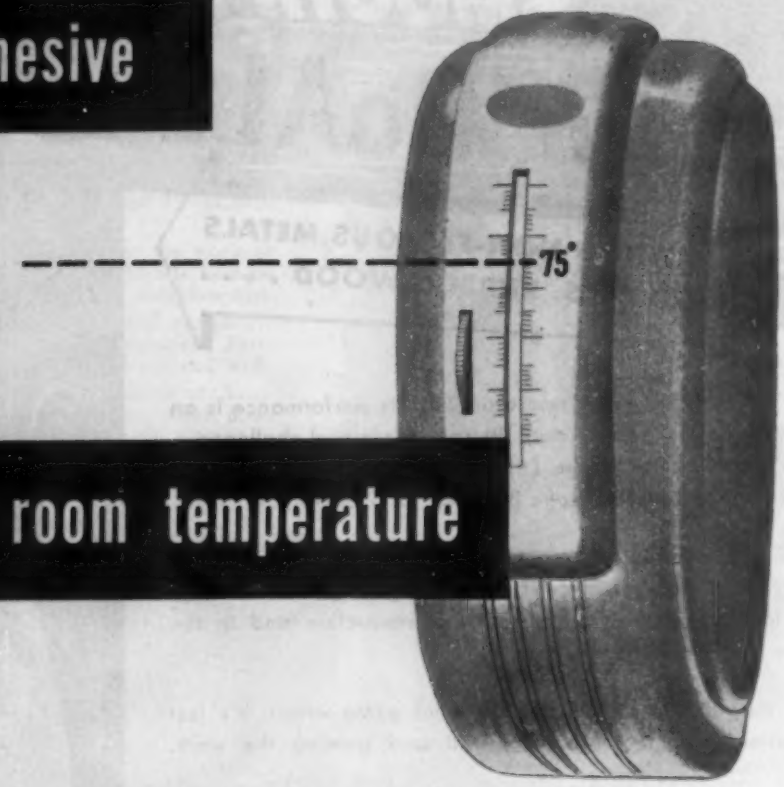
1330 S. Washington Avenue • Minneapolis 4, Minn.

Sales & Service Offices: Baltimore, Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, El Paso, Erie, Grand Rapids, Hartford, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, Minneapolis, New York, Orlando, Philadelphia, Pittsburgh, Providence, Reading, Rochester, Rockford, St. Louis, San Francisco, Seattle, Springfield, Syracuse, Toledo, Tulsa

WORLD'S LARGEST PRODUCER OF SYNTHETIC RESINS

RCI

new phenolic adhesive



cures at room temperature

No. 6000 PLYOPHEN

resists boiling water, alcohol, other solvents

Out of the research laboratories of Resin Headquarters comes a new product of almost unlimited usefulness—an adhesive resin curing at temperatures as low as 75°F. . . . providing a firm bond at pressures as low as 25 lbs. . . . and resistant to prolonged immersion in boiling water, alcohol and other solvents.

Tests have established that this adhesive produces bonds with very high break strengths and wood failure with either thin veneers or heavy ship's timbers. The curing cycle can be speeded up, by increasing temperature, for example, to as little as 1½ minutes at 180°F. Formulation is simple, requiring only the addition of No. 6001 Plyophen catalyst. No. 6000 Plyophen is also adapted to the interbonding of laminates, molded plastics, wood and a host of other materials. Write for details direct to the Sales Department at Detroit.

Saturday Evenings at 8:30 (E. W. T.)
You Will Enjoy RCI's
"Symphony of the Americas"
Via Mutual Network Stations

REICHHOLD CHEMICALS, INC.

General Offices and Main Plant, Detroit 20, Michigan

Other Plants: Brooklyn, New York • Elizabeth, New Jersey • South San Francisco, California • Tuscaloosa, Alabama • Liverpool, England • Sydney, Australia

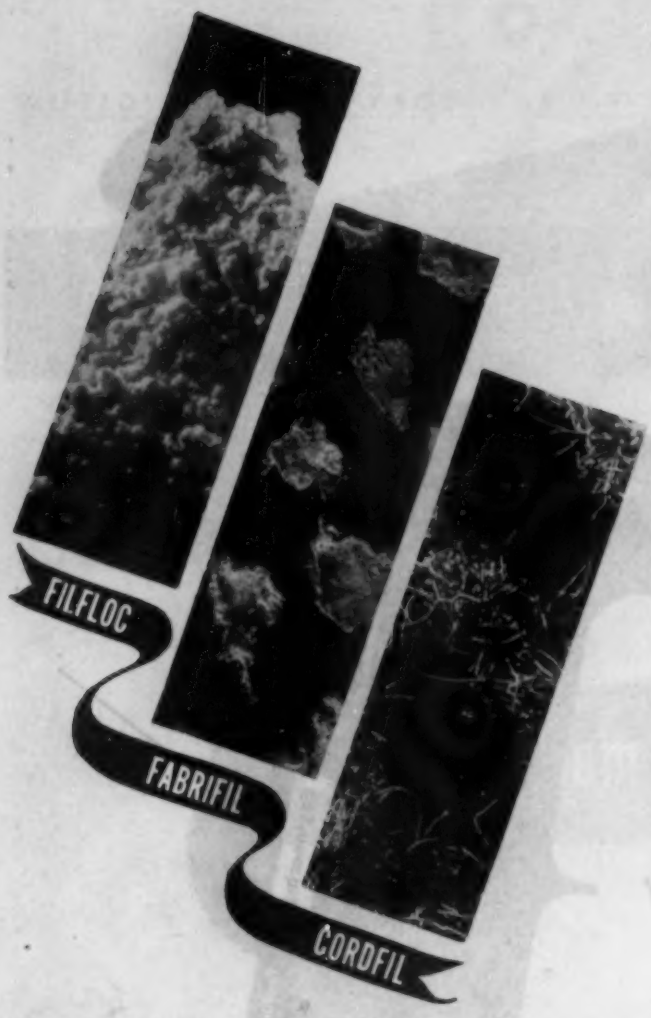
SYNTHETIC RESINS • CHEMICAL COLORS • INDUSTRIAL PLASTICS • INDUSTRIAL CHEMICALS

Engineering

In this vital phase we offer you careful planning from original design to finished product. We are staffed to engineer your most complicated plastics problem, whether it be a small part or a complete unit. For postwar plastics think of Bridgeport.

BRIDGEPORT MOULDED PRODUCTS, INCORPORATED

BRIDGEPORT CONNECTICUT



Fillers

PLUS –

MAKING fillers is one job. Assisting in the scientific selection of a filler suited to each item EXACTLY—that's another job. Rayco does both! This plus-value of our service is liked by both molders and compound manufacturers. They add cotton fillers for product improvement. They add Rayco Fillers to assure MAXIMUM improvement.

Try Plastic Helmet Liner Scrap

Let us assist you in utilizing this low cost molding compound of the phenol-formaldehyde type. Its possibilities are great — and so is its economy. Ample supply available.

RAYCO

Fillers

RAYON PROCESSING CO. of R.I. INC.

Developers and Producers of Cotton Fillers for Plastics

60 Tremont St. Central Falls, R. I.

LET US DEMONSTRATE WHAT ELECTRONIC HEATING can do for YOU

PROOF BY TRIAL . . . that's our motto. Before you invest in electronic heating equipment you should be shown how any process requiring heat can be done *better, faster* and *more economically* for you with a Scientific Electric unit.

Our engineers will gladly—*without obligation*—make a study of the heating process under consideration. They will then make recommendations supported by practical demonstrations on the S.E. heater best suited for the job.

This procedure will enable you to figure accurately the economies that will result; also permit you to estimate the time required to pay for the equipment out of resultant savings.

You can submit your heating problems to us with the assurance that absolute secrecy will be observed, if so desired. Investigate the advantages of applying electronic heating in your manufacturing operations NOW. Consult with us at your earliest opportunity.

Write for free copy of
The ABC of Electronic Heating

Manufacturers of
Vacuum Tube and Spark Gap Converters Since 1921

3 KW DIELECTRIC HEATER
Dielectric Heating Units priced from **$1500.**
(3 KW complete)

5 KW INDUCTION HEATER
Induction Heating Units priced from **$1285.**
(for 5 KW complete with 1 work coil)

Scientific Electric

DIVISION OF "S" CORRUGATED QUENCHED GAP COMPANY

119 MONROE ST. GARFIELD, N. J.

Scientific Electric Electronic Heaters are made in the following range of power; 3—5—7½—8—10—12½—15—18—25—40—60—80—100—250 KW. — and range of frequency up to 300 Megacycles depending on power required.

A New Home for PLASTICS EDUCATION

Now even finer educational facilities are available to those who seek thorough, practical plastics instruction. Plastics Industries Technical Institute has moved its Los Angeles resident engineering school to new and larger quarters on a five-acre campus. The Administration Building is shown in the picture above.

The resident school will continue to provide practical training in its shops and laboratories with equipment similar to that used by the plastics industry. You are cordially invited to visit the new campus when in Los Angeles. Meanwhile, we welcome your inquiries regarding resident plastics training and the home study course.

Plastics
INDUSTRIES TECHNICAL
INSTITUTE

Francis A. Gudger, President · John Delmonte, Technical Director

WRITE DEPT. MP5-5

122 EAST 42ND ST., NEW YORK 17, N.Y. ★ 221 NORTH LA SALLE ST., CHICAGO 1, ILL. ★ 1601 SOUTH WESTERN AVE., LOS ANGELES 6, CALIF.

PLANNING to use molded plastics . . . today . . . tomorrow? If you are you'll want a copy of this new booklet. It's brimful of practical, helpful information that every buyer of molded plastics should have. It gives you an idea of what plastics are good for . . . and what their limitations are. It points out some of the more important "do's and don'ts" in designing . . . explains mold-making, molding, finishing . . . gives, in chart form, the characteristics of the more popular molding materials. And it's profusely illustrated throughout with charts, diagrams, drawings, and photos.

In short, it's full of practical, down-to-earth facts . . . the kind of information you'll want whenever your job calls for plastics. And since it's based on our quarter century of experience in the business, we believe it's a book you'll want to have . . . and keep.

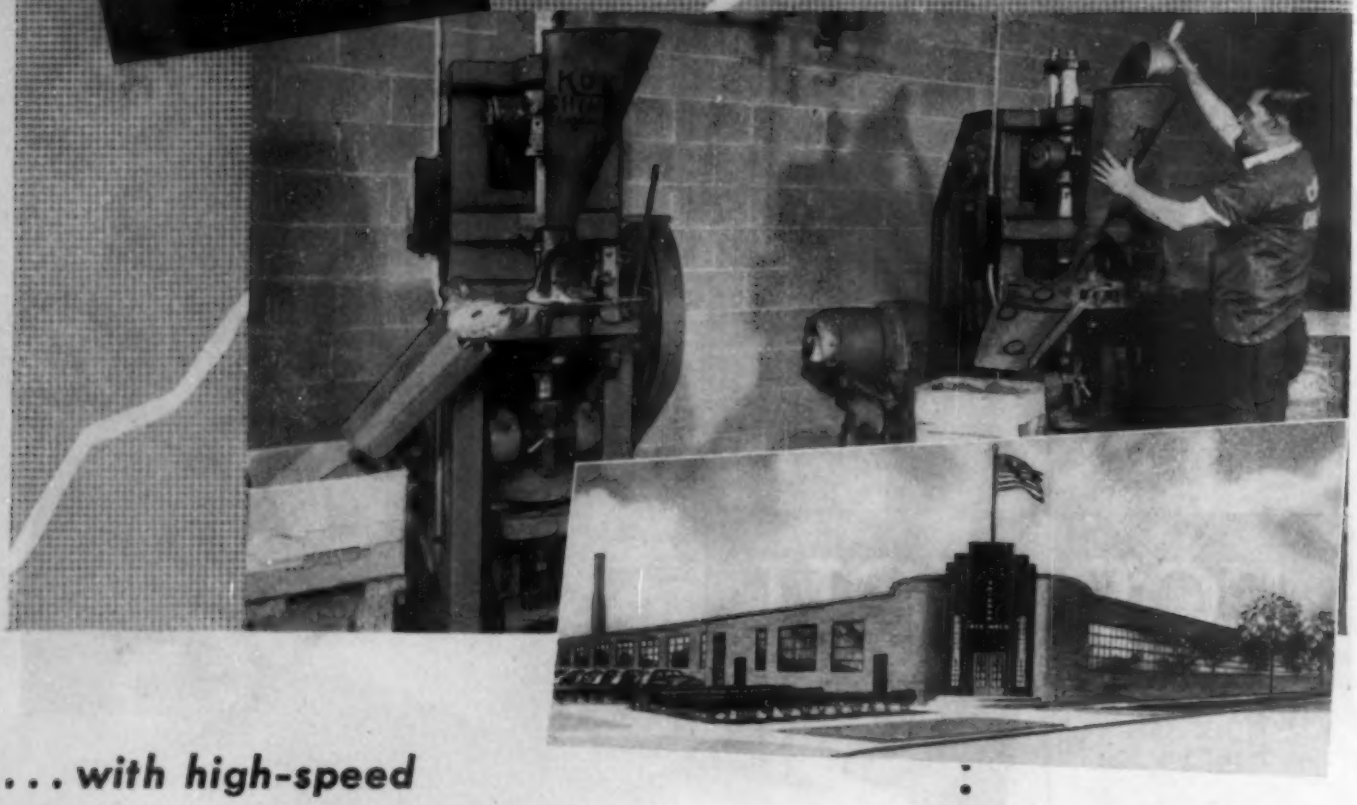
No . . . there's no charge. Just drop us a line on your company letterhead and your copy will be sent pronto . . . with our compliments. Since the supply is limited, we suggest you write today.

CHICAGO MOLDED PRODUCTS CORPORATION

1046 N. Kolmar Ave. Chicago 51, Illinois

COMPRESSION, INJECTION, AND TRANSFER MOLDING OF ALL PLASTIC MATERIALS

UP Goes Output in the Modern, New Plant of the Chicago Die Mold Co.



. . . with high-speed KUX PREFORM PRESSES

Efficiency is the keynote of Chicago Die Mold's operations. This progressive plant's sharply increased use of electronic preheating has stepped production way up . . . made quantity production of preforms a necessity.

Chicago Die Mold had been successfully using Kux Press Model #60 for years. So when the need for additional preform equipment became evident, it was natural that they select another Kux Press for their increased production. Today, two Kux Presses are turning out great quantities of preforms for Chicago Die Mold . . . cutting preforming cost to a minimum . . . substantially reducing molding time.

Kux Presses may be the answer to your preforming problem, too. Write to Dept. MP for catalog or demonstration.

Flexible New **MODEL #60**

- produces preforms 2½ in. diameter
- has 2 in. die fill
- applies 30 tons pressure
- punch and die set-up or change-overs made quickly
- tablet thickness and weight easily controlled

Kux, pioneer in machinery for the Plastics Industry, has a complete size range of preform presses in both single punch models and multiple punch rotaries.

KUX MACHINE CO.

3924-44 WEST HARRISON STREET · CHICAGO 24

GET UNIFORM HIGH QUALITY IN

ILLUSTRATED ABOUT ACTUAL SIZE

Standard Diameters up to 2 INCHES

We are now in a position to produce polystrene, cellulose acetate and butyrate rod in the following standard diameters—$\frac{1}{8}$", $\frac{3}{16}$", $\frac{1}{4}$", $\frac{5}{16}$", $\frac{3}{8}$", $\frac{1}{2}$", $\frac{5}{8}$", $\frac{3}{4}$", $\frac{7}{8}$", 1", $1\frac{1}{2}$", $1\frac{3}{4}$", and 2". Send along your request for further information concerning SANDEE rod. It can be easily fabricated for model work as well as production items.

SALES REPRESENTATIVES IN 19 PRINCIPAL CITIES

Sandee Manufacturing Company

3945 NORTH WESTERN AVENUE · CHICAGO 18, ILLINOIS

EXTRUDED PLASTICS AND SPECIAL TOOLS

WE BUY, SELL, PROCESS

PLASTICS SCRAP

ACETATE · BUTYRATE · VINYLS · POLYSTYRENE · ACRYLICS

H. MUEHLSTEIN & Co. INC.

122 EAST 42nd STREET, NEW YORK 17, N. Y.

LOS ANGELES: 1431 E. 4th St. · MEMPHIS: 45 W. Virginia Ave. · CHICAGO: 327 So. La Salle St. · AKRON: 250 Jewett St. · BOSTON: 31 St. James Ave.

Here is the **ANSWER** to your

High Pressure Reducing Valve Problems

Seldom do we find higher pressures in plastics plants than 6000 lb. per sq. in. Consequently this reducing valve, shown at the left, is the one we usually recommend. It handles working pressures up to 6000 lb., without shock—oil, water, or air—and it does so well that we are receiving repeat orders nearly every day from satisfied users in the plastics field alone. It is our

ATLAS Type "E"

High Pressure Reducing Valve

This value performs so well because it is modern in every detail. The body, for example, is of forged steel. The internal metal parts are entirely of stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure.

Ask for complete information.

For other ATLAS plastics plant products see the partial list in our ad in the January 1945 issue of MODERN PLASTICS

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

277 South Street, Newark 5, N. J.

Representatives in principal Cities

EXTRUDED THERMO PLASTICS

★

Made to Order ONLY
No Stock Items
Details, Quotations — *Promptly*

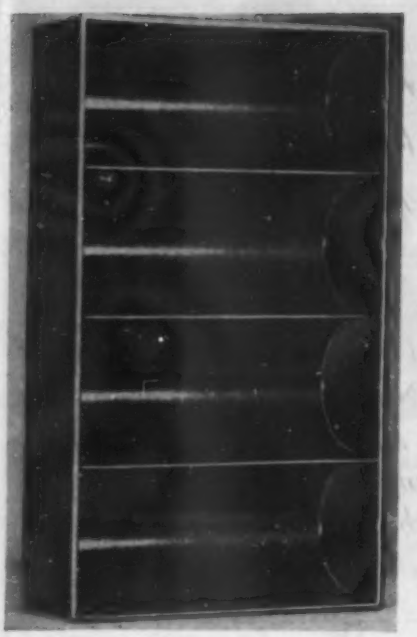
Ameroid

Casein Plastics

IN RODS, DISCS, SHEETS AND PUNCHED FLAT SHAPES for fabricators. Non-inflammable, readily turned and machined. Wide color range.

AMERICAN PLASTICS CORP.

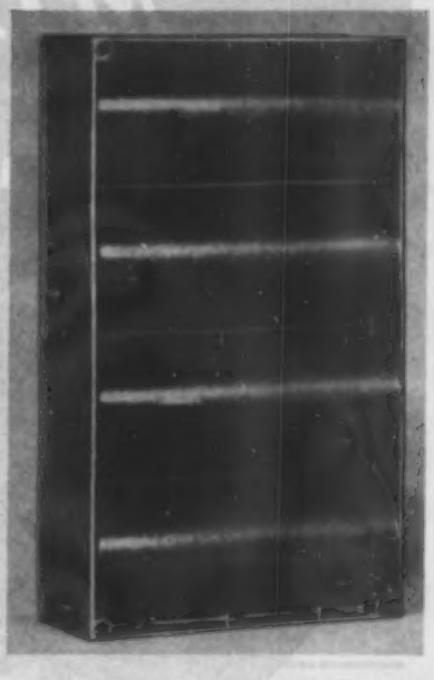
225 West 34th St. New York City 1

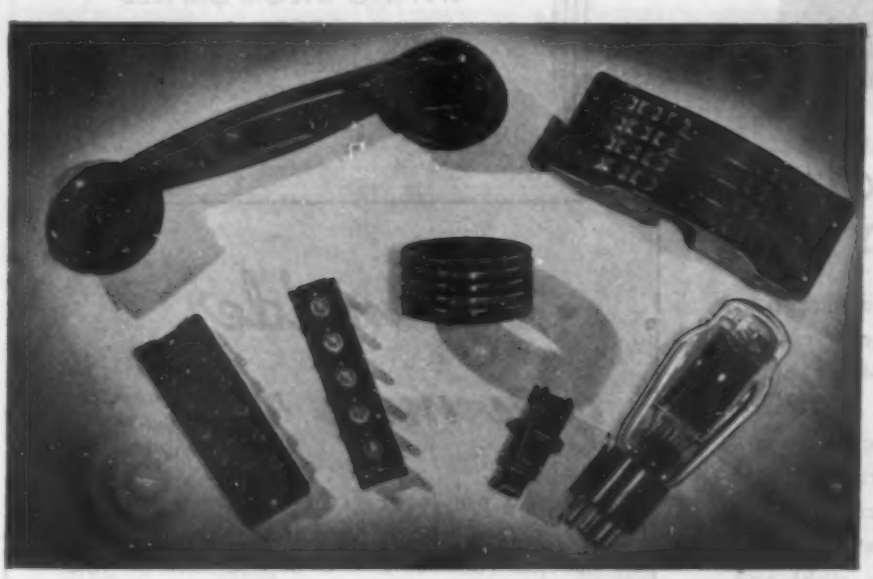


Shortages in critical materials?

Use MAKALOT K.E.M.

Here is an excellent example of the moldability and fine finish of Makalot Brown Mottled K.E.M. This very beautiful and practical SILVER TRAY molded of K.E.M. is 17″ x 10″ x 4″ and weighs approx. 5 pounds. Molded by Northern Industrial Chemical Co. of 7-11 Elkins St., South Boston for Measuring Devices Corp. of New York this large container shows the outstanding workmanship of this expert molder. The picture on the left shows the inside of the tray. Note K.E.M.'s excellent flowing qualities on this large piece. The back of the tray is pictured on the right. K.E.M. is the right compound for your less critical applications. The demand for this material is so great we can not promise to fill all orders—but we'll do the best we can. Cafeteria Trays, the beautiful Chesterfield and Chiclet Trays, Thermos bottle tops, valve float toilet balls, stove handles, etc., are but a few of the many articles molded of MAKALOT K.E.M.





MAKALOT THERMOSETTING
WAR COMPOUNDS

On the left is shown a few of the many contributions Makalot is making to the War Effort. Makalot is being used in making Bomb Boosters parts for airplanes, jeeps, tanks, radar, etc. We particularly call your attention to Makalot's non-cracking around inserts material. Great stress around inserts during cooling because of shrinkage requires a phenolic that will retain "flow" until the molded piece is cooled. Makalot's non-cracking Phenolic materials meet this need and as shown by the illustrations of the finished pieces does a job that any molder can well be proud of. Whether your job calls for Impact, General purpose, Low loss, or super impact—remember MAKALOT NEVER FAILS THE USER!

Domestic Representatives

CENTRAL STATES
C. R. Olson
1020 15th St.
Rockford, Illinois

PACIFIC COAST
Milton Turk
1425 S. Flower St.
Los Angeles, California

PACIFIC NORTHWEST
Northwest Plastics Industries
415 4th and Cherry Bldg.
Seattle 4, Washington

921 Terminal Sales Building
Portland, Oregon

PHENOLIC RESINS · FURFUREL & FURFUREL IMPREGNATING RESINS · MOLDING COMPOUNDS · PHENOLIC LACQUERS · VARNISHES

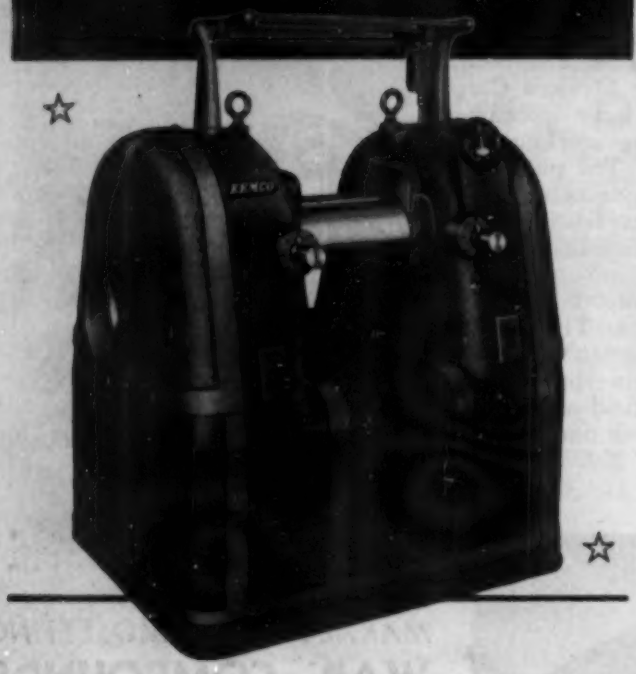
"KEEP 'EM MOLDING"

Makalot
CORPORATION
PLASTICS

262 Washington St., Boston, Mass.

The Independent Producer of Superior Plastics

EEMCO MILL



FOR SMALL PRODUCTION AND LABORATORY USE

This modern streamlined mill is designed to process thermosetting and thermoplastic plastic materials, also natural and synthetic rubber. Ideal for small production runs or laboratory experimentation, it is entirely enclosed and ready to operate. Variable speed drive permits any desired speed from 38 to 75 surface feet per minute. Specially built foundation is unnecessary. All controls are within sight and easy reach of operator. Simple cover removal makes mechanism readily accessible. Ask for Bulletin BR 2.

MILLS • REFINERS • WASHERS • EXTRUDERS • STRAINERS
HYDRAULIC PRESSES • CALENDERS • TUBERS • CRACKERS

EEMCO

ERIE ENGINE & MFG. CO.

953 EAST 12th ST., ERIE, PENNA.

Attention, Plastic Manufacturers!

You will find that IVANO PEARL DISPERSIONS in Cellulose Acetate, Nitrocellulose and Ethyl Cellulose produce a wide range in the degree of opacity and lustre when dispersed in plastics

Fine Chemicals Division
IVANO INCORPORATED
166-184 Commercial St.
Malden 48, Mass.

A molder you may rely on

If you are looking for a molder who will operate as an integral part of your production—almost like a department of your own plant—whose schedules will mesh with yours, whose production standards are as high as you require—then you may be interested in our compression molding service. Some of the finest names in American industry are numbered among our clients.

KENILWORTH PLASTICS MOLDING COMPANY

Division of Eureka Button Co. (Est. 1885)
KENILWORTH, NEW JERSEY

Many leading manufacturers have particular molding problems continually cropping up which they turn over to ACCURATE engineers and facilities knowing full well that a thoroughly satisfactory product will result from the work of ACCURATE craftsmen whose particular attention to specific detail and precision always produces a perfect product. . . . Compression and Transfer Molding is our specialty . . . watching Costs, important . . . Satisfying you, essential. Make ACCURATE your headquarters for tough problems NOW . . .
NO OBLIGATION!
CCURATE MOLDING CORPORATION
132 NASSAU STREET BROOKLYN, N. Y.

GLYCERINE

QUICKLY AVAILABLE AT A STOCK POINT NEAR YOU!

Armour's 332 stock points mean fast, dependable service for your present and future glycerine needs.

CHEMICALLY PURE or U. S. P. . . . A high grade, water-white glycerine meeting the requirements of the United States Pharmacopoeia. Suitable for use in foods, pharmaceuticals, cosmetics or for any purpose where the highest quality is demanded. It has a specific gravity of 1.249— 25°C./25°C.

HIGH GRAVITY . . . A pale yellow glycerine for industrial purposes with a specific gravity of 1.262— 15.5°C./15.5°C.

DYNAMITE . . . A yellow glycerine made especially for the explosives trade. It has a specific gravity of 1.262— 15.5°C./15.5°C.

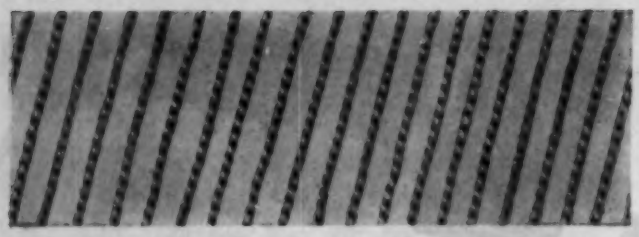
YELLOW DISTILLED . . . A yellow glycerine for industrial purposes with a specific gravity of 1.259— 15.5°C./15.5°C.

ARMOUR AND COMPANY
1355 WEST 31ST STREET · CHICAGO 9, ILLINOIS

COTTON DUCKS
for
Laminators and Molders

Our Southern mills have made high-tensile cotton fabrics for the Plastics Industry for fifteen years and specialty industrial cotton textiles for over thirty-five years. Our experienced development and production facilities are available to the Plastics trade, limited only by the requirements of our armed forces.

Curran & Barry
320 BROADWAY NEW YORK CITY



SURCO-AMERICAN

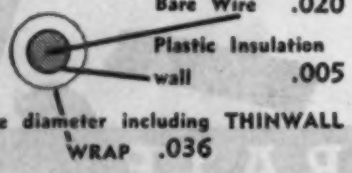
New **THINWALL WRAP**

PLASTIC INSULATED FINE WIRE

UNBELIEVABLY THIN

- Maximum saving of space and weight
- Unlimited identification
- Reduced heating factor

EXAMPLE:



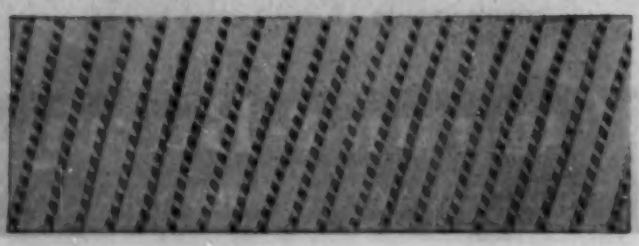
Surco-American Thinwall Wrap is the first fine wire, plastic insulated, and cotton wrapped to occupy such a small space. Here within 36/1000 of an inch are all of the advantages you could ask of an insulated wire: exceptional low and high maximum operating temperatures, abrasion resistance, soldering iron protection, the widest range of identification, with minimum weight and space. Write for complete information.

Surprenant

ELECTRICAL INSULATION CO.

Dept. T

84 Purchase St., Boston 10, Mass.

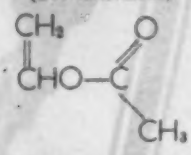


Now Available Without Restrictions

UNPOLYMERIZED

VINYL ACETATE

(STABILIZED)



Purity 99.5% **Boiling Range 71.8° to 73°C.**

Vinyl Acetate can be polymerized to form resins with exceptional bonding qualities for wood, glass, metal and fibre

Containers:—

410 lb. drums; 62,500 lb. tank cars

For further information write to:

NIACET

CHEMICALS CORPORATION

4740 Pine Avenue • Niagara Falls, N. Y.

SPECIALISTS

INJECTION MOULDING

THE

GROTELITE Co.

INCORPORATED

GRANDVIEW & LAFAYETTE AVE.

BELLEVUE, KENTUCKY

THE LEADING SCRAP GRINDER
of the Plastic Industry in
CARTER PRODUCTS CORPORATION

Operator feeding extruded scrap into Ball & Jewell Heavy Duty Ideal scrap grinder in Carter Products Corporation plant, extruders of Cleveland, Ohio.

Mr. O. C. Wilson, General Manager says "We have found the Ball & Jewell machine entirely satisfactory and what is more important, we have always been able to get replacement parts from the Ball & Jewell Company."

Heavy Duty Ideal model has 7 solid tool-steel knives, extra heavy semi-steel castings, uses 5 H.P. motor with 3 belt Texrope drive. Outboard SKF ball bearings sealed against dust. Handles scrap up to one inch sectional thickness.

Write for prices, FREE catalog of 13 models.

BALL *and* JEWELL
20 Franklin Street Brooklyn 22, N. Y.
or get in touch with nearest representative
CHICAGO: Neff, Kohlbusch & Bissel. DETROIT: J. C. Austerberry's Sons. LOS ANGELES: Moore Machinery Co. LOS ANGELES & SAN FRANCISCO: Machinery Sales Co. NEW ENGLAND: Standard Tool Co., Leominster, Mass. ATLANTA, GA.: George L. Berry. ST. LOUIS: Lemmore Sales Co. SEATTLE 4, WASHINGTON: Olympic Supply Co. KANSAS CITY, KANS.: Fluid Air Engineering Co.
LONDON, ENGLAND: Blackfriar's Engineering Co., Ltd.
AUSTRALIA, and NEW ZEALAND: Scott & Holladay, Pty. Ltd., SYDNEY
STOCKHOLM, SWEDEN: Ingenjorsfirman Teknova
CANADIAN AGENT: Williams & Wilson, Ltd., Toronto & Montreal, Canada

This is #4 of a series of advertisements showing typical Ball & Jewell scrap grinder installations in the plastics industry.

A PLASTIC ANSWER
TO YOUR PROBLEM

The secret of success in plastics is in knowing the right plastic to use for the job at hand. Many items are practical to make in plastics for those who have the "know how." ● Your work at Magnetic Plastics is custom moulded from plastics best suited for the job. ● Ask us to help you see what plastics can do in your business. Just send photo, sample or specifications, and we'll tell you quickly if it can be made in moulded plastics.

THE MAGNETIC PLASTICS CO.
1900 EUCLID BLDG. • CLEVELAND 15, OHIO

COTTON FABRICS
FOR REINFORCING
PLASTICS
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J. H. LANE & CO., Inc.
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Specialization!

A SPECIFIC FASTENER FOR A SPECIFIC APPLICATION!

That is where MILFORD has the answer when it comes to using semi-tubular, tubular, split or special rivets and machine screws, too.

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The MILFORD RIVET & MACHINE CO.

EASTERN DIVISION — CENTRAL DIVISION
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VICTORY* will mold Plastics for you...

We'll be ready to do a better molding job for you . . . when we've finished supplying the needs of many prime contractors to the Armed Forces.

Molding plastics for War still demands most of our time and equipment . . . it's VICTORY'S* bit toward complete Victory . . . but it's also paving the way for *better-molded* products for you in the days of Peace.

Wartime lessons in precision molding have sharpened the wits of our engineering staff. Solving tough problems has broadened our knowledge of handling a great variety of thermo-plastics. Our workers are better craftsmen because they have learned the importance of *extreme* accuracy.

Whatever plastic product you're planning to use, consult with our engineers at once. On certain contracts we may be able to begin molding *right now.*

Member: Society of the Plastics Industry

AUTOMATIC INJECTION MOLDING

Small and large parts

UP TO 17-OZ. SHOTS

Lumarith, Tenite, Fibestos, Plastacelle, Crystallite, Lucite, Ethyl Cellulose, Polystrene, Lustron, Styron, Cellulose Acetate and others . . . all molded to your exacting specifications.

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A complete converting service!
It will pay you to investigate our facilities for reworking your scrap.

CELLULOSE ACETATE — CELLULOSE BUTYRATE
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GP PLASTIC MATERIALS

A Dependable Source of Supply for re-worked Cellulose Acetate and Cellulose Butyrate molding powders

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Mixers: Plain or Stainless
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reconditioned molding powder SOLD

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materials

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***WE SEPARATE ALL CONTAMINATIONS,** removing steel or other mixtures—metal or anything else—and rework and plasticize the material into first class, ready-to-use reprocessed molding powder.*

***BUY FROM US** when reconditioned molding powder is needed for your process. You'll find our product a trustworthy and reliable element. Contact us at our modern plant. Inquiries will receive prompt attention.*

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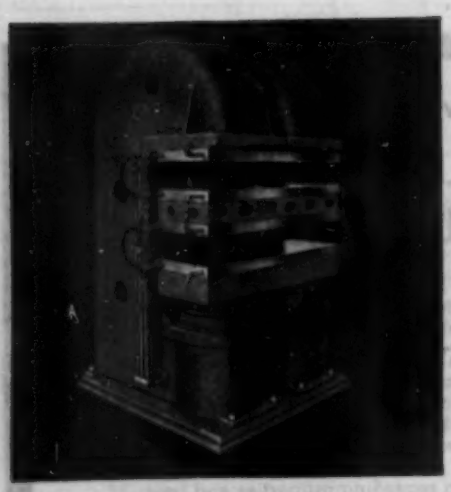

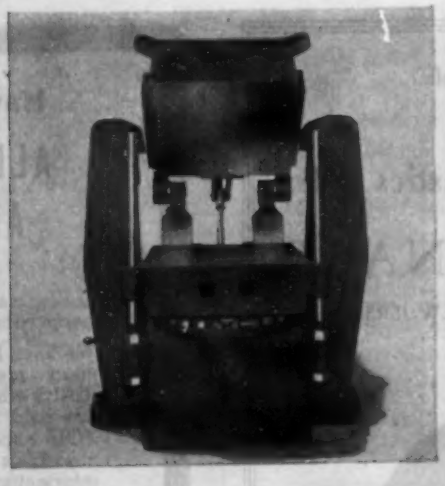

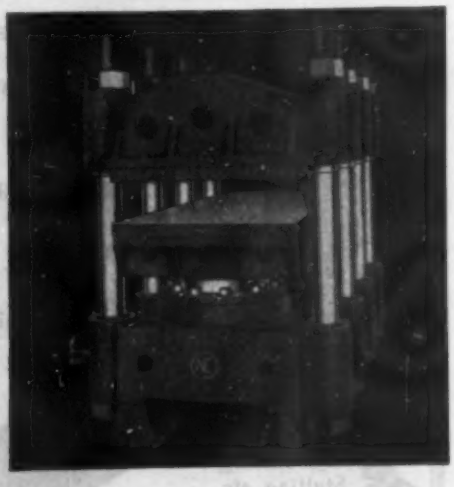

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Yes, our plastic background can do much to assure the success of your plastic future.

For new ideas in plastic mold and tool design, engineering and manufacture based on over 25 years' experience (that's Larry Cook's record), look to Lawrence H. Cook, Inc.

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Manufacturers of Plastic Molds & Tools

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HOW MISKELLA INFRA-RED OVENS AND APPLIANCES SERVE THE PLASTIC INDUSTRY

Branch of the Industry	Name of Appliance	Use
Molders (Thermo-setting) Compression	PELLET-VEYOR (Variable heat)	To preheat pellets and preforms at the press as needed
Molders (Thermo-plastic) Injection	VIBRA-VEYOR (Variable heat)	To preheat plastic powder automatically. To dry plastic powder automatically
Injection	HOPPER-HEATER (Variable heat)	To warm up heavy metal of hopper of molding machine
Molders (Thermo-plastic) Extrusion	STRIP-HEATER (Variable heat)	To preheat strip rolls of vinylite, etc., automatically as fed to worm
Material Manufacturers	Special production Equipment including vibrators, conveyors, stainless steel belts and electronic devices	To process various kinds of plastic material in bulk
Fabricators (Miscellaneous)	BENCH-KIT In various sizes (Variable heat)	To soften sheets, rods, tubes and any shape for bending, forming punching, etc. This includes Cellulose, Acetate, Methyl Methacrylate

(The time on most of the operations mentioned above averages five minutes)
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Enables you to do faster, easier sawing at high speeds

BARNES *Skip Tooth* BAND SAWS

Their greater chip clearance results in less heat generation, lengthened saw life, and prevents clogging of the teeth even at speeds of 2500 to 4500 S.F.M. This means faster, smoother, easier cutting of plastics, compositions, fibre, wood, etc., as well as aluminum, soft brass, magnesium and other soft non-ferrous metals.

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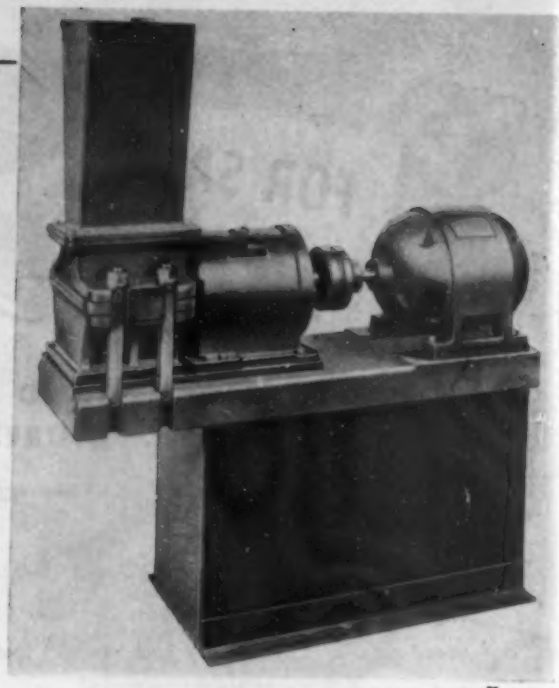
★ Call your Mill Supply Distributor for full details and prompt delivery of the Barnes Skip Tooth as well as other Barnes Band Saws and Hack Saw Blades.

ESTABLISHED 1919

W. O. BARNES CO., INC.

DETROIT 14, MICHIGAN

Cumberland Scrap Grinders are built for Plastics



Cumberland scrap grinding machines will granulate your plastics scrap economically and efficiently.

These machines are simple in design, rugged in construction and easy to dismantle and clean.

Our new post-war models, now available, are the most modern machines of this type obtainable. The four sizes available provide a machine for every purpose.

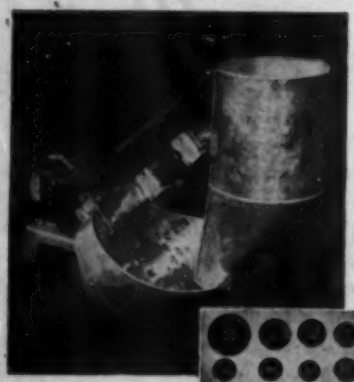
Send for complete information.

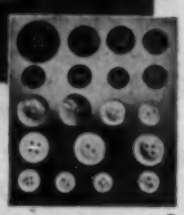
CUMBERLAND ENGINEERING CO.

Dept. A. P. O. BOX 216 PROVIDENCE, R. I.

Automatic Button Finisher-

ELIMINATES MANPOWER PROBLEMS





THIS compact automatic machine punches fins and cleans holes of Urea, Phenol and Melamine buttons. Completely automatic it saves countless man-hours of work and performs with perfect efficiency. Can be set & re-set to handle all sizes. 3 models: Model S accepts sizes 12 to 34; Model SP accepts sizes 36 to 50; Model SX accepts sizes 12 to 50. Production up to 450 per minute.

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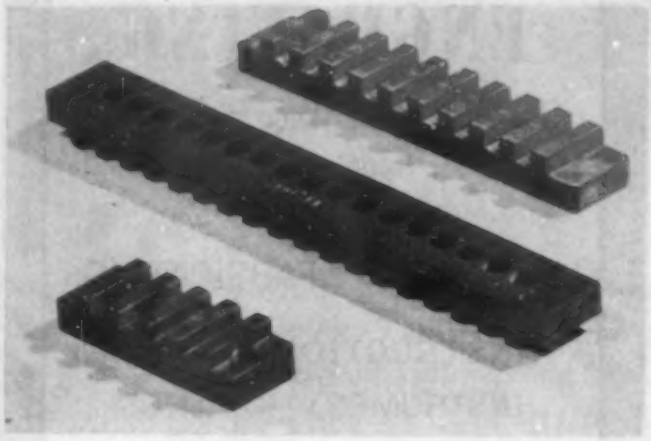
★ HOLLYWOOD, CALIFORNIA ★

SKILLED AND TOOLED FOR PRECISION MOLDING

Terminal Strips...



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"Castles in the Air"

Your post-war dream product can turn into a nightmare through mis-application of plastics. That's why Auburn engineers study the product from design stage to end use . . . to determine *whether* it's a job for plastics . . . to suggest the *right* plastics material and the *best* molding method.

You can depend on our recommendations because we mold all types of materials and use all standard molding methods. Our 69 years of experience in building molds and making parts is your guarantee of uninterrupted, economical production.

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For small parts molded automatically at low cost, write: Woodruff Company Division, Auburn Button Works, Auburn, New York.

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All Types of Molding Complete Mold Shop
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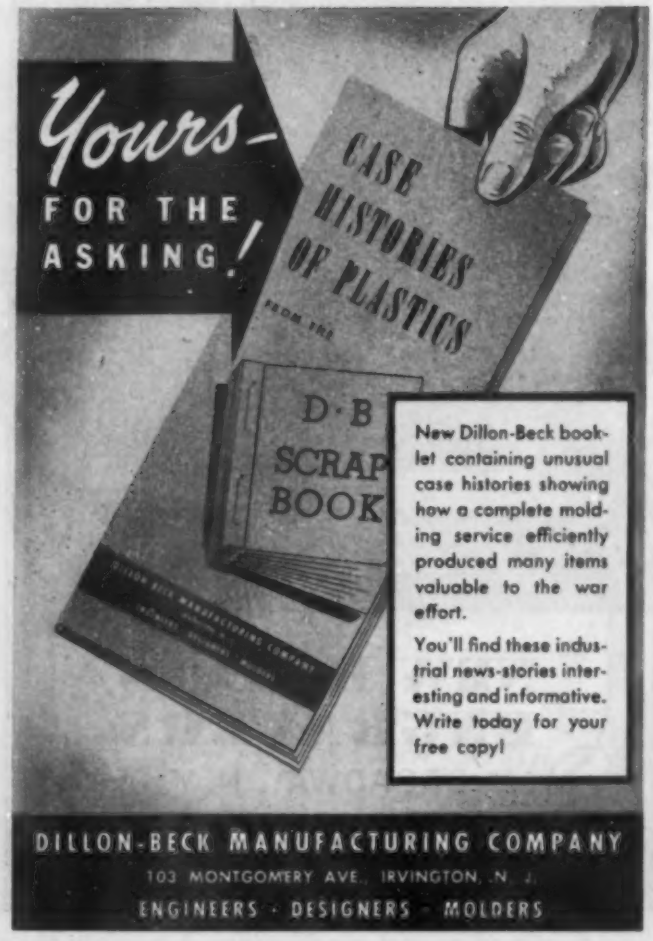

New Dillon-Beck booklet containing unusual case histories showing how a complete molding service efficiently produced many items valuable to the war effort.

You'll find these industrial news-stories interesting and informative. Write today for your free copy!

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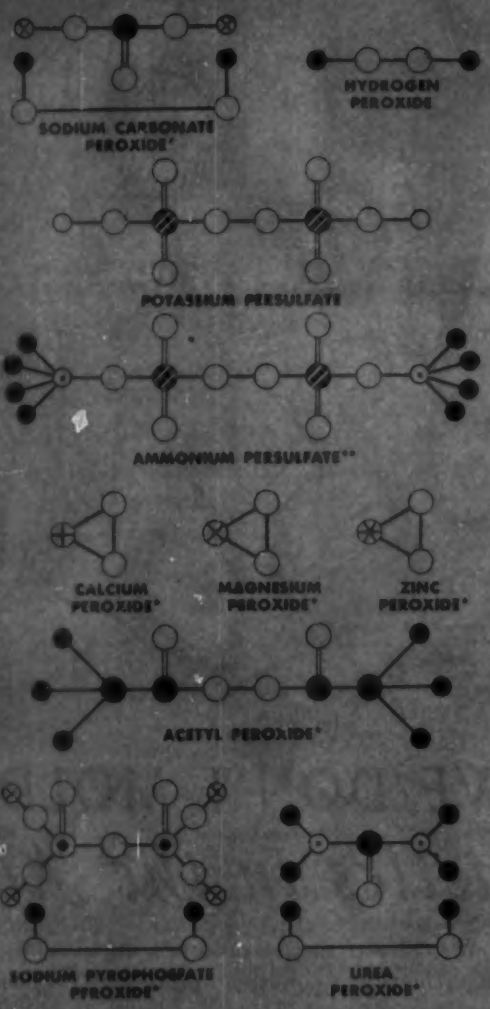
ENGINEERS · DESIGNERS · MOLDERS

ACTIVE OXYGEN IS ON ACTIVE DUTY



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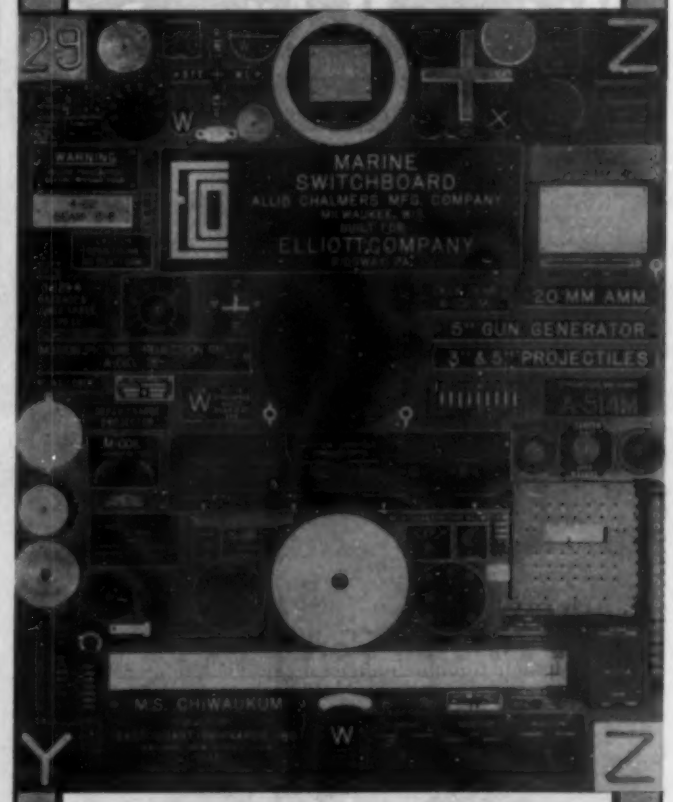

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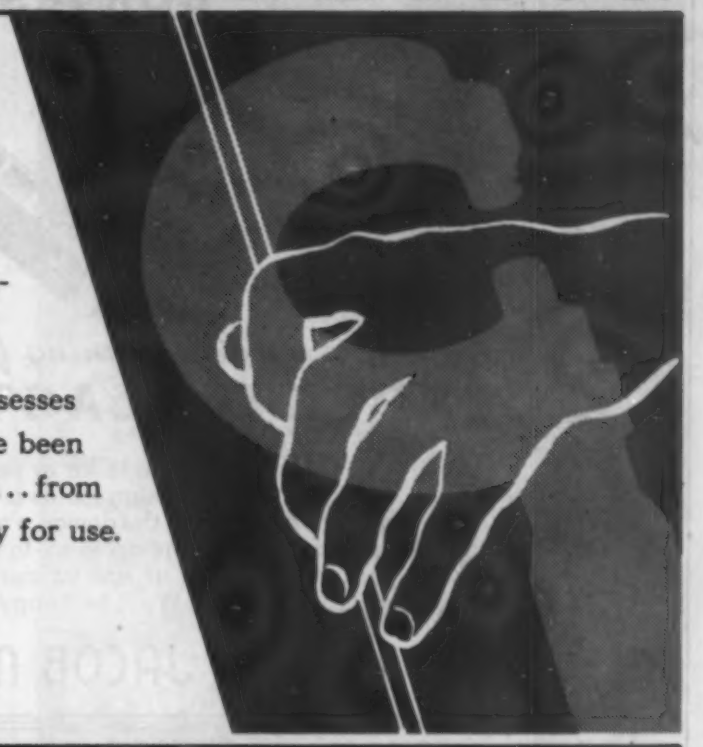
— Imagination
— Skill

MICROMETRICALLY EXACT molding is no accident — it is the result of creative imagination and consummate productive skill.

THE IDEAL PLASTICS ORGANIZATION possesses that *happy combination.* That's why we have been able to handle so many difficult molding jobs . . . from the initial problem to finished products, ready for use.



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A DIVISION OF IDEAL NOVELTY & TOY CO., INC.
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INSOLUBLE
HEAT AND LIGHT RESISTANT

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Color samples supplied on request.

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EXPERT PLASTIC MOLDING

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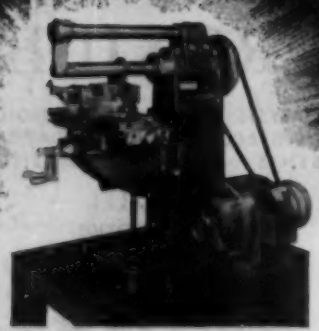

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benchmaster — offers a bench milling machine easily convertible from a conventional horizontal to a vertical miller by simply interchanging the spindle attachments.

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We'd like to tell you more about hobbed cavity molding and our unique facilities for handling your particular problems.

Write for our booklet, "The Procedure of Die Hobbing."

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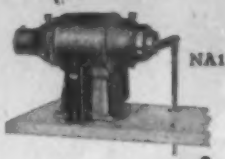
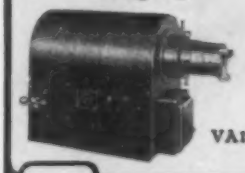
For accurate, uniform, speedy finishing of metal & plastic parts.

AWARDED October '42


NA1E

NA1C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VA1B – variable speed lathes, in bench and pedestal models, chuck and collet types.

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We can serve you best when you send full details to Research Department, Miracle Adhesives Corporation, 852 Clinton Avenue, Newark 8, New Jersey.

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Covering a World of Uses with

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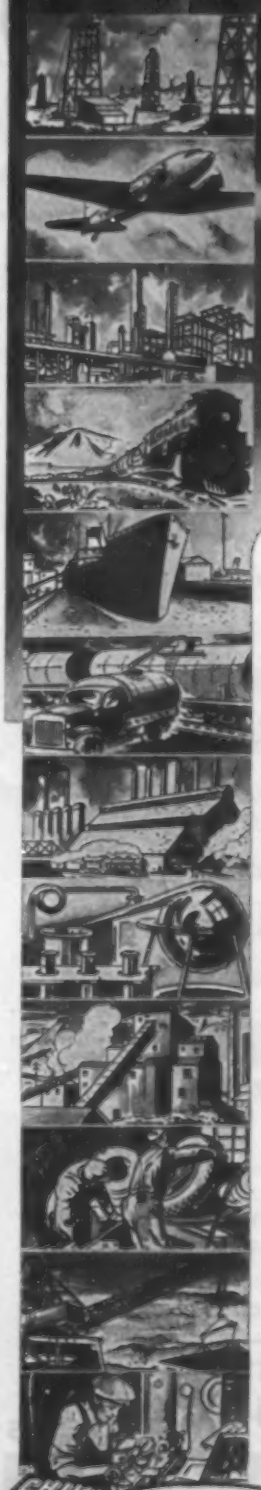

On land and sea and in the air . . . wherever liquid, air or vapor lines must swing or turn to provide for movement of equipment, vibration or easy handling . . . CHIKSAN *Ball-Bearing* Swivels render safe, dependable service.

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CHIKSAN COMPANY
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When the war is won and the production fight begun, *remember* the experience of "Connecticut" is yours to draw upon.

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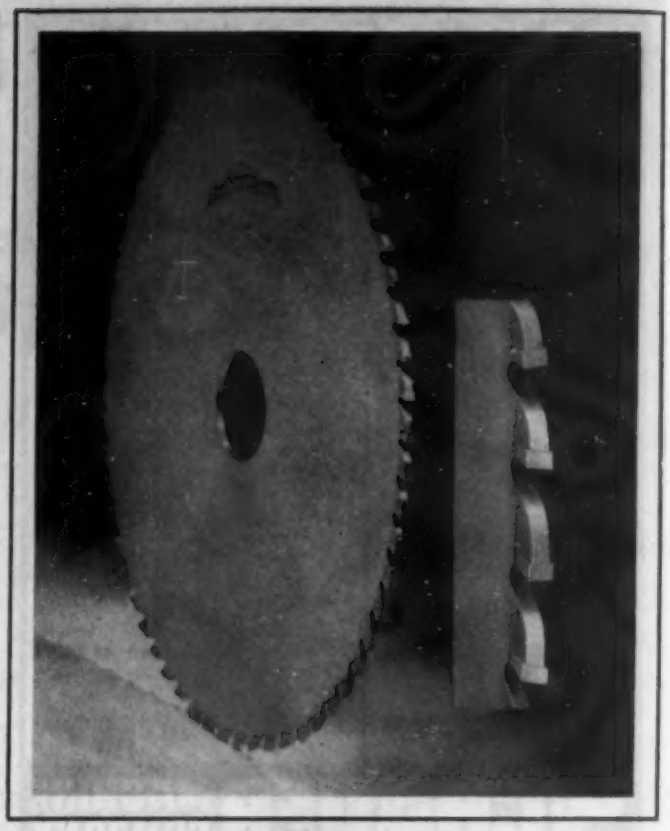
Custom CONNECTICUT *Plastics* **Molders**

CONNECTICUT PLASTIC PRODUCTS CO.

70 WEST LIBERTY STREET — WATERBURY, CONNECTICUT



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CIRCULAR SAWS

have teeth tipped with Tungsten Carbide

...TO CUT MORE PLASTIC

and run longer between sharpenings

Carboloy cutting points, brazed onto the teeth, enable these Simonds Saws to give exceptionally smooth cutting and long service life on practically any type of plastic except thin-walled stock. For smooth cuts the tips are flush with the concave-ground sides of the teeth. But for heavy cutting not requiring smooth finish, the teeth are set alternately left and right. These saws are made on order.

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SEND FOR FREE BOOK... *tells how to cut any type of plastic* . . . also tells how to determine saw specifications and how to get best results from Simonds Circular Saws. Write for a copy.

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Patented

A handy, single wheel Stamp for stamping figures and letters on brass, aluminum or soft steel, and also plastic and wood, with but a single hammer blow. More efficient than individual hand stamps because all figures are on one wheel and entire alphabet on two wheels. Change of characters are quickly made by rotating the type wheel. Wheels are renewable. One stamp does away with 12 individual hand stamps. Wheel is made of tool steel and characters engraved for maximum stamping service. Characters furnished any size from 1/16" up to 3/8". Also can be supplied with shank for press. Write for Bulletin MP-1H.

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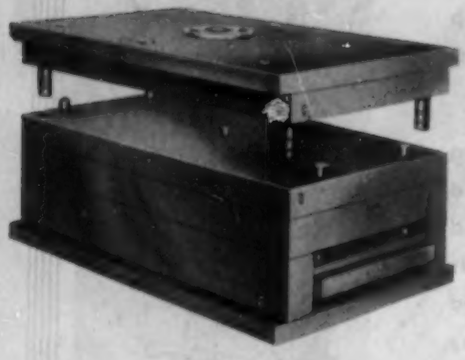

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STANDARD MOLD BASES

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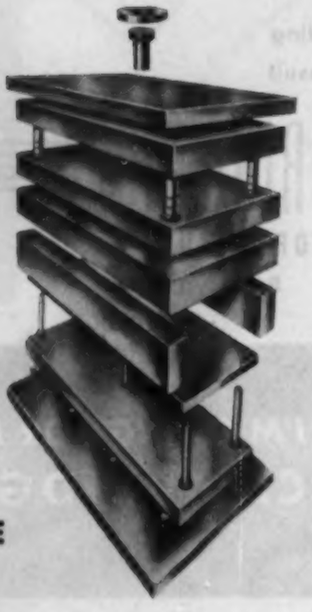
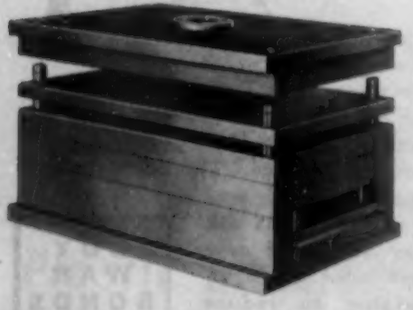
STRIPPER PLATE MOLD BASES





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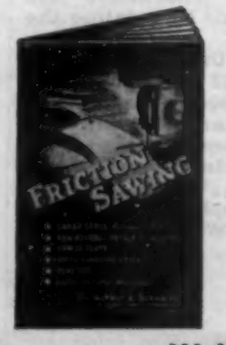

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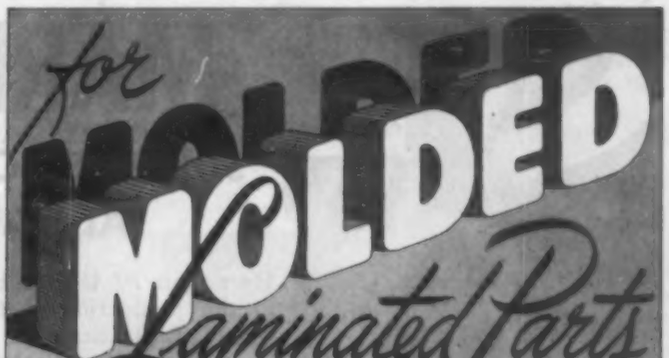

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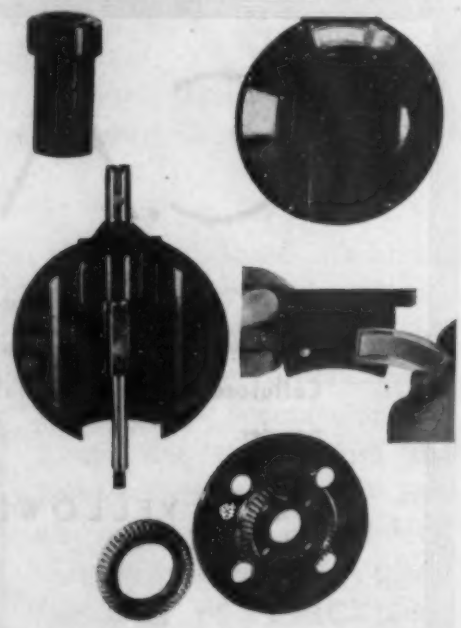

Approximate diameter of Main Housing - 9"
Total weight of moulded parts - 6 lbs.

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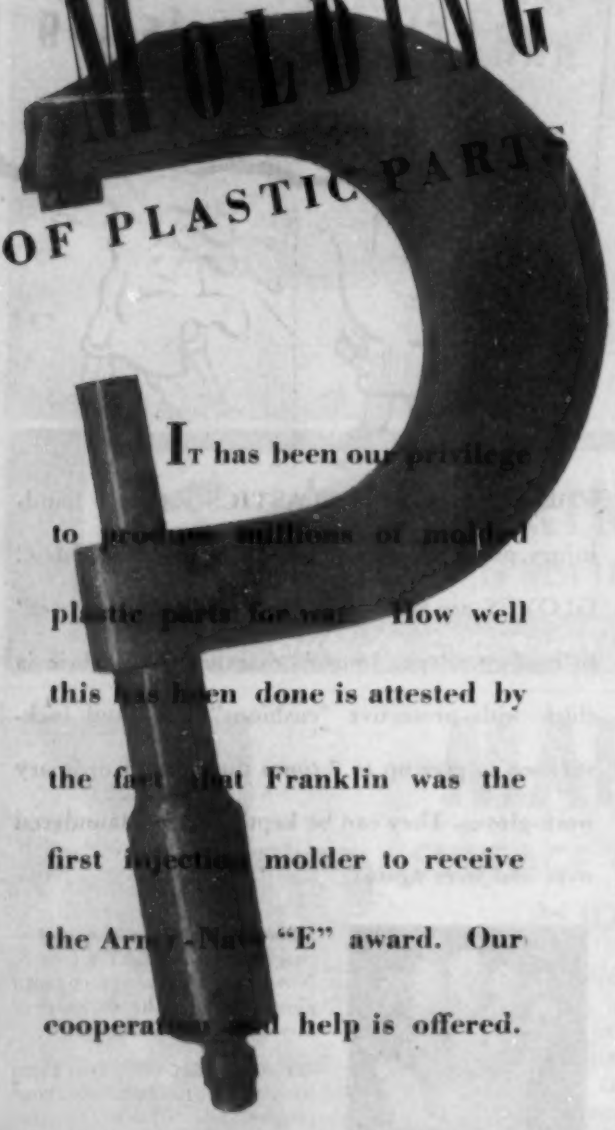

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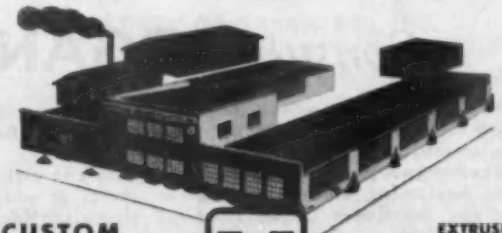

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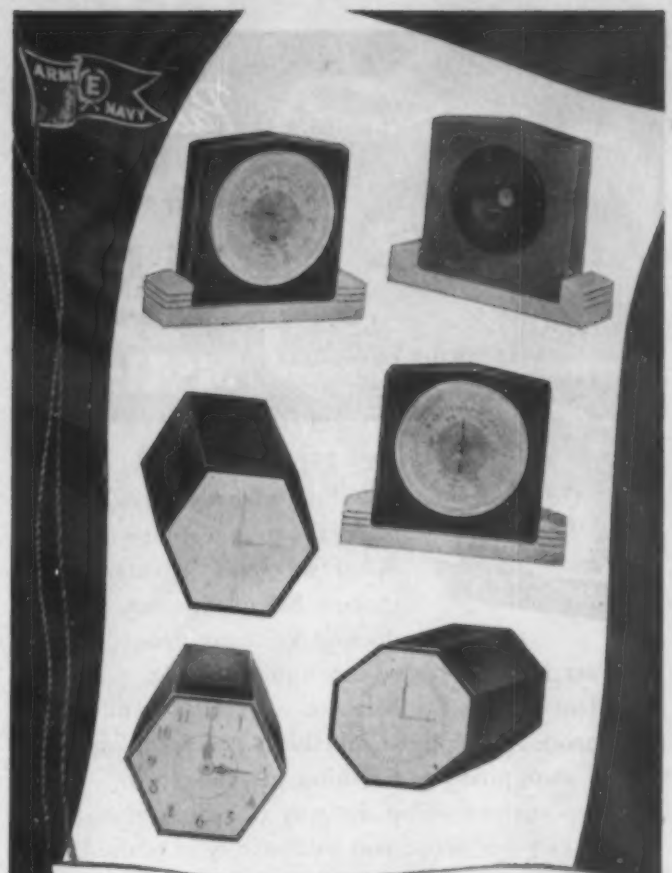

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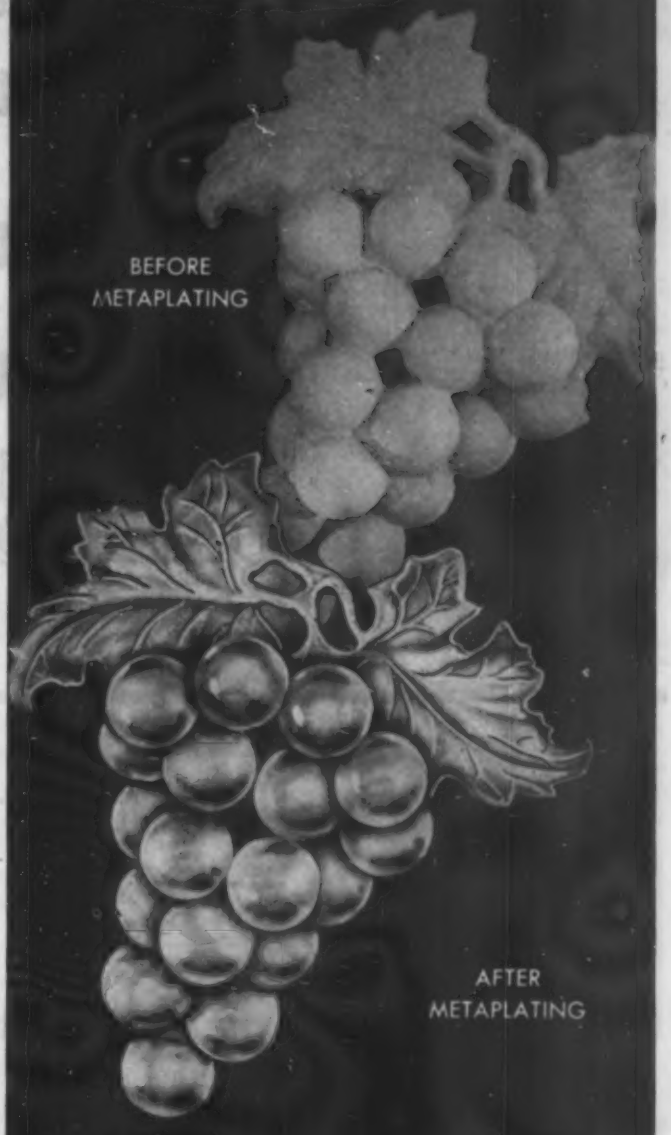

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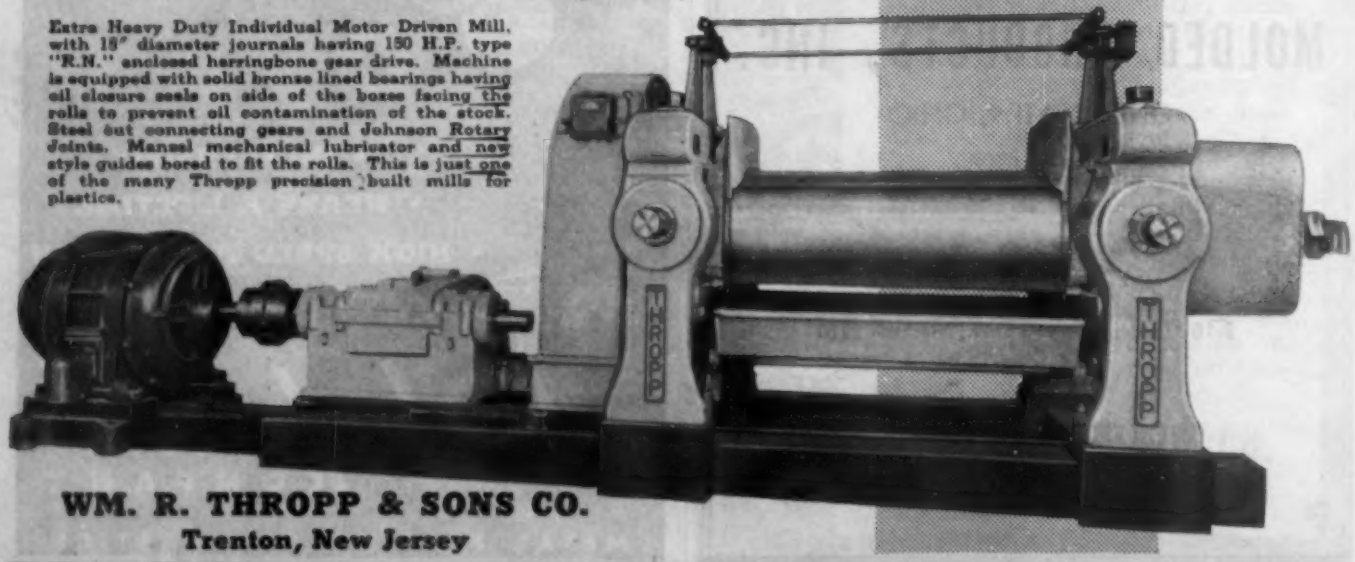

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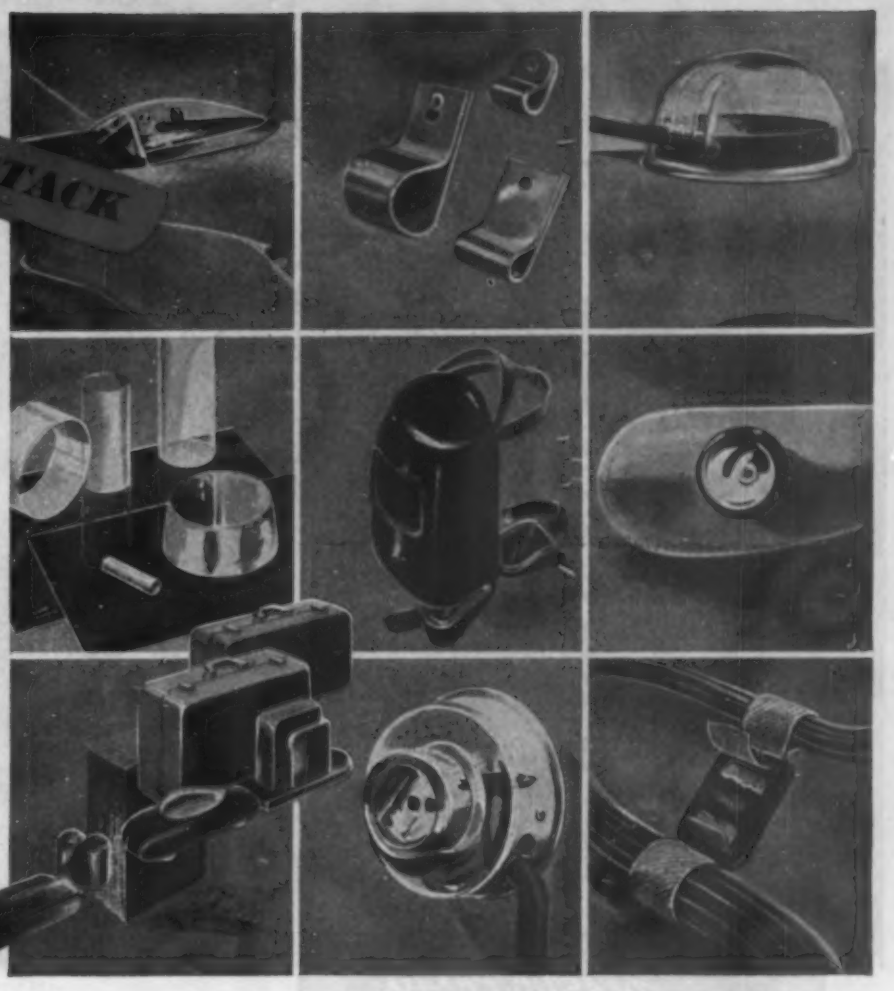

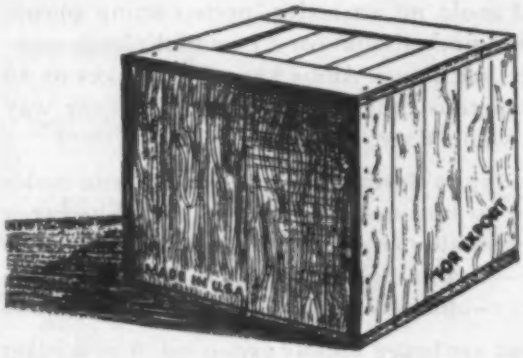

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Classified Advertisements

For further information address Classified Advertising Dept. MODERN PLASTICS 122 East 42nd St., New York 17, N. Y.

WANTED: PLASTIC SCRAP OR REJECTS in any form. Cellulose Acetate, Butyrate, Polystyrene, Acrylic, Vinyl Resin, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding and magnetizing. Reply Box 318, Modern Plastics.

FOR SALE: 1—500 ton Hydraulic Press with downward moving ram and pushbacks. Box 512, Modern Plastics.

PRODUCT DESIGN ENGINEER—Graduate architect or industrial design engineer, under 35 years of age, to initiate and develop new consumer product designs in glass. Should have manufacturing experience and ability to coordinate his work with Sales, Production and Research departments.

Here is a real opportunity to join America's leading glass manufacturing company. This is a new position, with excellent prospects for the man willing and able to do creative work. If not now engaged in essential war work, write Personnel Department, giving complete description of education, professional experience, draft status. Enclose recent photograph. Salary commensurate with abilities. All replies confidential.

CORNING GLASS WORKS
Corning, New York

PLEXIGLAS and LUCITE SCRAP WANTED. Interested in small and large quantities of clean, irregular-shaped flat pieces, strips, rods and other cut-offs. All thicknesses; masked and unmasked. Kindly describe fully, stating quantity available. Box 1210, Modern Plastics.

WANTED: Small or medium sized plastic molding plant with either hydraulic extrusion or injection equipment with or without tool shop. Advise full details. Reply Box 788, Modern Plastics.

IN THE MARKET FOR: Stainless Steel or Nickel Kettles, Vacuum Pan, Preform Machine and Mixer, Hydraulic Presses. Reply Box 825, Modern Plastics.

WANTED: Cellulose Nitrate sheets or strips of .060 to .070 thickness, suitable for stamping blanks from ¾ inch to 3 inch diameter. Prefer transparent but can use some laminated in colors. Send samples with quotations to Florida Supply House, 415—12th St., Bradenton, Florida.

WANT WORK for 50 Ton and 100 Ton Plastic Compression Molding Presses. Can start work immediately. Minnesota Aircraft Company, 2526 Nicollet Avenue, Minneapolis 4, Minnesota.

LINE WANTED: A live-wire sales representative covering all big chain stores and jobbers desires to contact a reputable manufacturer of plastic items, preferably Novelties, Housewares, Toys or Notions. I am thoroughly familiar in the plastic field having marketed many nationally known products. I maintain a New York office, have an extensive following and can assure you of volume distribution. Commission basis, or will finance. Reply Box 1224, Modern Plastics.

FOR SALE—1 Worthington Hyd. Pump 1 x 6, 5 GPM 6000 pressure M.D. 1 Set 18" x 36" compounding rolls. 1—14"x 24" Press, 9" ram; 4—24" x 53" steel cord Heating Platens; 4—W. & P. Mixers; 4—Semi-Automatic 100-ton Hydr. Presses, platen area 20" x 36"; Allen 6" Tuber; Dry Powder Mixers; Pulverizers, Grinders, etc. Send for complete list. Reply Box 447, Modern Plastics.

CANADA, A Large Post War Market—Wide-awake, reliable Canadian sales organization, having connections with wholesale hardware, chain and department store trade, can accept representation for additional factory requiring Canadian factory agents operating on commission basis, providing line does not conflict with present representations. H. HACKING CO. LTD., 144 Water Street, Vancouver, Canada (Est. 1916). Canadian Branches from Coast to Coast.

DETROIT DESIGNING SERVICE
Specializing in Designing of Machines, Tools, Stamping Dies, and Plastics Molds.
We also do plant layout and postwar planning.
7104 W. Warren Ave. Detroit, Mich.
TY 71641

WANTED: THERMOPLASTIC SCRAP or rejects in any form, including Acetate, Butyrate, Styrene, Acrylic and Vinyl Resin materials. Submit samples and details of quantities, grades and color for our quotations. Reply Box 508, Modern Plastics.

PERMANENT CHEMIST WANTED for Research Laboratory investigations to improve and develop synthetic resin adhesives—essential war work at present. Salary in line with experience.

Plant within 200 miles of New York City. Attractive town and working conditions.

Applicant should have Ph.D. and organic chemical research experience, preferably in urea-, phenol- or resorcinol-resin adhesives.

Write, giving age, education, draft status, experience, salary expected and photo if available. Address R. J. Spahr, Casein Company of America, Bainbridge, N. Y.

WANTED: Chemist or Chemical Engineer, experienced in production control and testing of Plastics. To assume charge of Laboratory testing, development work and some field service. Prefer individual with training in thermosetting laminates. Give experience, education, draft status, send photograph if possible. Location—Mid-West. All replies held strictly confidential. Reply Box 1162, Modern Plastics

WANTED: Watson-Stillman Injection Molding Machine Operator with Radio Manufacturing Concern—Permanent position. Write to Personnel Manager, Washington Institute of Technology, 4810 Calvert Road, College Park, Maryland.

FOR SALE—One 5 H.P. Steam Boiler 200 lb. pressure, low-water cut-off, condensation tank and Motor-driven pump like new, used only two months. Also one 39 cavity stock mold for Bakelite pipe bowls. Reply Box 1235, Modern Plastics.

FOR SALE:

Watson-Stillman Hydraulic Pump—high pressure 3000 lbs. Low pressure 250 lbs. 3.3 gal. per min. high pressure, 16.2 gal. per min. low pressure, 15 H.P. motor and starter.

1—Dunning & Boschert Press 11" Ram 24" x 24" Platens 38" stroke—35" Daylite. 3000#.

1—H.P.M. Press, Semi auto. 10" Ram, 20" x 20" Platen 9" Stroke, 26" Daylite, 3000#.

1—Hyd. Press—10" Ram, 20" x 20" Platens, 9" Stroke, 24" Daylite, 3000#.

Prices FOB Chicago
Reply Box 1236, Modern Plastics

AMERICAN BUSINESS MAN who owns production facilities in FRANCE looks for new technical products for either manufacture or distribution in the European postwar market. Will resume his residence in France, is perfectly familiar with language and economic conditions and has close personal contact with scores of leading French industrialists and business men. MANUFACTURERS interested in EXPORT business please reply to Box 1237, Modern Plastics.

SUPT. Mold Making, Injection, and Compression Molding, Designing and Estimating, wishes to get in contact with newly organized company or otherwise. Available about May 1st. Reference. Address Box 1238, Modern Plastics.

INJECTION Plastic Production Man: Age 35, Married, Draft Deferred. Have 11 years' experience in Optical Frame Field. Supervised 120 people. Know Injection Molding Equipment. Interested in firm in or contemplating equipping injection plastic department. New England location desired. Would accept other location if opportunity warrants. Reply Box 1239, Modern Plastics.

PLAN FOR TOMORROW for Post-War. Pioneer firm in plastics trade offers services. Write what you can offer now or later on. P. M. Wishkhoor & Co., 82 Jangi Shiwala, Amritsar (India). Estd. 1910—Cable Wisco. Head Office Bombay 2.

WANTED Surplus Tenite Plasting Tubing, any color, outside 5/16" diameter, 1/2" hole or smaller. Wanted immediately other sizes of Plastic Tubing. Also equipment available for doing Plastic Screw Machine Work in small lots and other fabricating work. Prompt delivery. Forward all replies to Mark Specialty Co., 406 Temple Bldg., Rochester 4, N. Y.

WANTED—Vinyl Film, about .004 for manufacturing purposes. No priorities. Reply Box 1240, Modern Plastics.

DISCHARGED VETERAN, would like connection with manufacturer or Sales Organization selling, Sales Promotion or Research in Plastics. Reply Box 1241, Modern Plastics.

WANTED: PLASTICS ENGINEER

To head plastics production of established smaller company. Trained staff, all types of molding presses and tool room facilities. Excellent post-war prospects. Liberal salary and opportunity for advancement to executive rating. Qualifications: Practical experience and training in: design and production of molds, dies, supervision of tool room activity; drafting knowledge; knowledge and experience with injection and compression presses and production. Engineering degree preferred but not essential if applicant has had practical experience and supervision in field. Address Modern Plastics, Box No. 1242, for interview. State qualifications, training, background, and experience.

WANTED:

Executive in Charge of Production

An established concern with national outlets in the electrical and electronic field is seeking an able executive for administration of plant and production. Excellent post-war opportunities, liberal salary with chance for advancement and executive title. Not a large concern but one well-known in its specialized field. Qualifications: administrative experience in production supervision and control, personnel handling, production methods. Confidential private interviews by appointment. Address Box 1243. Stating experience and qualifications.

PLASTIC ENGINEER

Graduate Chemical Engineer to develop plastic compounds and molding methods; study applications; set up equipment for product development. Work primarily of an engineerng nature. Two or more years' experience in plastic development desired, also some experience in compound and molding processes and equipment. New position with excellent prospects. Salary commensurate with ability. All replies confidential. Submit full details to:

Personnel Administration
Radio Corporation of America
RCA Victor Division Camden, N. J.

CAN USE vinyl scrap in soft form such as cable stripping, slabs, pieces, etc. Need immediate and continuous supply. Address Box 1250, Modern Plastics.

DISTRIBUTOR covering the East Coast and Middle West with a large following among the wholesale stationery and toy trade, wholesale drug sundries and jobbers of general merchandise. Interested in making connections with a manufacturer of plastic toys and novelties suitable for the above trade. Will carry own accounts. Reply Box 1249, Modern Plastics.

REQUIRE EMBOSSING for large quantities of vinyl plastic slabs 0.120 thickness. If you have facilities communicate Box 1244, Modern Plastics.

WANTED

PLASTICS ENGINEER

If you would like to represent one of the largest materials manufacturers in service and sales work, write fully as to your knowledge of compression molding, your age, draft status, business experience, schooling, and salary requirements. Box 1245, Modern Plastics.

Manufacturer's Representative
Having Intimate Contact with Important Chain & Dept. Store Buyers Is Opening New York Showroom.
Seeks Top Line
Plastic Merchandise
Excellent Reputation & References
Reply Box 1246, Modern Plastics.

FOR SALE: Watson-Stillman 225 ton Transfer Molding Press; Caldwell twelve 36" x 24" heated platens, 24" ram, 10" stroke; 12—Molding Presses 50 to 150 tons; Farrel-Birmingham 36" x 36", 12" ram; Adamson 30" x 40", 12" ram; Birm. 24" x 24", 9" ram; Watson-Stillman 30" x 36", 6½" ram; 24" x 36", 6" ram; 22" x 24", 5½" ram; 25" x 36", two 5" rams; 48" x 26", four 3½" rams; 78" x 36", two 7½" rams; 40 ton downstroke Broaching Press; 400 ton Hydr. Extrusion Press; Others up to 1600 tons. W.-S. Horizontal 4 plgr., 1" & 2" x 4", 4000 lbs. high & 850 lbs. low pressure. W.-S. 1½" x 12" horiz. 4 plgr., 30 GPM, 3300 lbs. 3—Oil Gear Pumps, variable capacity to 13 GPM and 1250 lbs. PSI; Oil Gear Pump, constant displacement 5 GPM and 1000 lbs. PSI; H.P.M. type vert. 2 plgr. motor driven, ½" & 1" x 4" high & low pressure, 3500 & 500 lbs; Wat.-Farrel 1½" x 4", Vert. Triplex, 6 GPM, 3000 lbs; Goulds 2¼" x 8" Vert. Triplex, 30 GPM, 1600 lbs.; Elmes 1" x 4" & 1½" x 4" Horiz. 4 plgr., 5 to 6½ GPM, 4500 lbs. & 5000 lbs.; Rumsey 4½" x 8" vert. Triplex, 65 GPM, 900 lbs.; 1-10 HP Horiz. 1¼" x 4" Triplex, 6 GPM, 3000 lbs.; Hydr. Steam Pumps up to 150 GPM; Low Pressure Pumps from 150 to 600 lbs.; Hydr. Accumulators, Tank & Weighted Types; Royle #2 Extruder; ½" & ¾" Preform Tablet Machines. Heavy duty double arm Mixers up to 150 gals.; Ball & Jewell No. 1½ Rotary Cutter; 800 ft. Ball Bearing Roller Conveyor, 12", 15" and 18" wide, 10 ft. lengths; Grinders, Pulverizers; Gas Boilers, etc. ONLY PARTIAL LISTING. WE BUY YOUR USED MACHINERY. STEIN EQUIPMENT CO., 426 BROOME ST., New York 13, N. Y. CANAL 6-8147.

AVAILABLE

ONCE MORE

PLASTIC DYES

for converting your plastic products to

15 brilliant transparent colors.

SCHWARTZ CHEMICAL CO.

326 West 70th, New York 23

AGENCY WANTED. ENGINEER, having excellent connections, with wide experience of Plastics desires to contact manufacturers anxious to establish present and post-war sales abroad. Please write—J. A. Harrison, 51 Yew Tree Rd, Hunts Cross, Liverpool, England.

FOR SALE: 10" x 18" Two Roll Mixing Mill; 1¼" Heavy Duty Preform Machine; Ball and Jewel Rotary Cutter. BRILL EQUIPMENT COMPANY, 225 West 34th Street, New York 1, N. Y.

Plastic Moldmaker and Repairman
Large Eastern manufacturer wishes to organize own department for making and repairing Plastic molds to service compression molding department already established. Full tool room equipment and facilities on premises. Company established 25 years with definite post-war business and job security assurance. Advise in full your experience, salary expected and when available. Reply Box 1247, Modern Plastics.

WANTED, Mechanic Hydraulic—one who fully understands rebuilding and installation of all Hydraulic Equipment. Permanent position. Reply Box 1248, Modern Plastics.

FOR SALE: Hydraulic Presses, 600 ton Watson Stillman 24" x 24" double acting ram, 1—36" x 36" 200 ton all steel construction 12" ram, 4—2 post 18" x 20" 8" rams, 52" x 26" 400 tons, 14" ram, 2—12" x 12" 7¼" rams, 2—12" x 12" 8" rams, 20" x 20" 14" ram, 2—32" x 50" 1 with 15" ram 4 openings 1 with 6" ram 3 openings, 26" x 45" 10" ram, 15" x 15" 8½" ram, 1—38" dia. 12" ram, 200 ton, pump attached; 4 Hydraulic Cylinders Hanna Model HP 14 8" dia. 36" stroke, 30 ton capacity, Pumps; Robertson Triplex 5 GPM 5000 lbs., Watson Stillman duplex high and low pressure. ¾ GPM 4000 lbs. continuous motor bedplate, Hele Shaw JLP 44 GPM 1200 lbs., HPM triplex 1¾ GPM 2000 lbs. on high 16 GPM 400 lbs. on low V Belt drive, National Triplex 1" x 3" 4000 lbs. Extruder; No. 2 Royle Perfected, Accumulator; weighted type 3" dia. 6' stroke; Mills, Calenders, Mixers, etc. Advise your requirements. HIGHEST PRICES PAID FOR YOUR USED EQUIPMENT. Universal Hydraulic Machinery Company, 285 Hudson Street, New York City 13.

WANTED

2—34" Mixing mills, 1—40" mixing mill, 1—36" Cracker with drives and motors, 1—2 roll Calender 60" goods, 1—3 roll Calender 57" goods, Extruders 3½" to 10" Royle Preferred. Reply Box 1229, Modern Plastics.

NOW IS THE TIME

to start post war planning and working on plastic molded parts Our engineers will be glad to call and discuss any problem having to do with compression or transfer molded parts.

RADIO CABINETS all sizes and other large housings are our specialty

All our molds are made by men with more than thirty years experience. Our engineers offer a similar background of experience. Combined, they guarantee production of highest quality, good looking moldings on the highest possible production basis.

CONSULTATION with our engineers is yours for the asking.

Plastimold, INC.
TRADE MARK
ATTLEBORO, MASS.

LEAVE THESE CHAIRS IN THE SUN AND RAIN

Incredible as it seems, fabrics woven of SARAN BY NATIONAL keep their bright colorful beauty indefinitely with never a sign of wear. Rain won't harm them . . . sun won't fade them. Dirt, grease, even ink can be wiped away with a damp cloth. To manufacturers of upholstered furniture this plastic wonder-material holds unlimited possibilities.

NATIONAL PLASTIC PRODUCTS Company
Odenton, Md.

Sleeve Type HYDRAULIC VALVES Reduce Circuit Shocks

RACINE Oil Hydraulic Valves utilize a sleeve design. The full inner sleeve provides a continuous bearing and sealing area. Ports through this sleeve are clean drilled holes, permitting a gradual metering of the oil flow — thereby reducing circuit shock.

End caps and bodies are standardized and interchangeable. Sleeve construction permits a wide variety of porting arrangements. These features contribute to mass production and low costs to you.

RACINE's complete valve line is designed for manual or remote solenoid and hydraulic controls. All standard iron pipe sizes from $\frac{3}{8}$" to $1\frac{1}{2}$" are available.

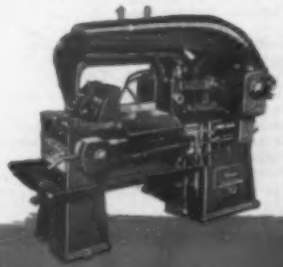
Consult our staff of field and factory hydraulic engineers. Ask them for a copy of Catalog P-10-C. At the same time, outline your hydraulic problems. Recommendations will be completed without cost to you.

"Variable Volume" Oil Hydraulic Pumps

RACINE provides a complete series of "Variable Volume" Pumps. Capacities: 12, 20 and 30 G. P. M. Designed to operate at 50 to 1000 lbs. P.S.I.

For more than 15 years RACINE Hydraulic Units have been used on presses, die casting machines, drilling and wood working machinery, lifts, elevators and machine tools as well as other applications. Complete data supplied on request.

THE PRODUCTION SAWS OF MODERN INDUSTRY



A complete line of the most modern metal sawing machines. Simple, fool-proof operation and control devices for fast, accurate cutting of any metal. Capacities 6" x 6" to 20" x 20" in all price ranges. Ask for complete Catalog No. 12.
RACINE TOOL AND MACHINE COMPANY,
1759 State Street, Racine, Wis., U. S. A.

RACINE ECONOMIES

- ★ Balanced Piston-Sleeve Type construction—more efficient operation and longer valve life.
- ★ Sleeve permits various porting arrangements and internal modifications—fewer valves required.
- ★ Valve bodies and caps are interchangeable—easy to change without disturbing pipe connections—saves time, labor and equipment.
- ★ Valve mounting feet are integral with main valve body. End caps and gaskets do not absorb pipe line vibrations.

RACINE

RACINE

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MODERN PLASTICS*
PLASTICS*
PLASTICS ENGINEERING*
PLASTICS PRODUCTS*
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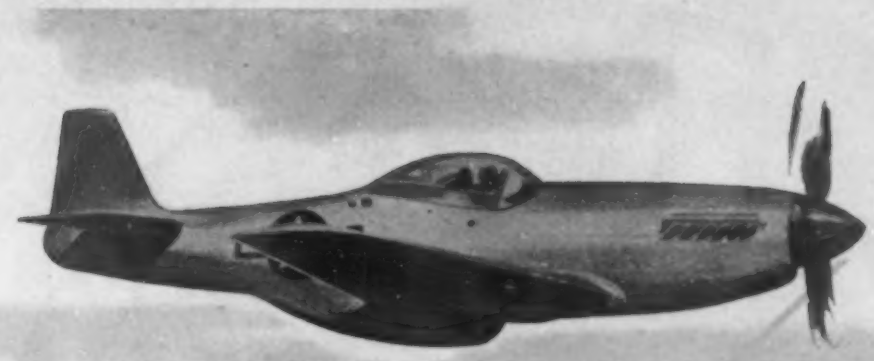
MODERN PLASTICS
Published by MODERN PLASTICS, INC
122 EAST 42nd ST., NEW YORK 17, N. Y



VISION...*unlimited*

The "teardrop" is a typical example of Swedlow research and ingenuity in the field of plastics. Shaped by a vacuum method, this one-piece Lucite enclosure eliminates blind spots and permits

full vision in all directions. Today all Swedlow

production is devoted to war, but Swedlow engineers are already working with manufacturers in many industries who visualize the unlimited postwar applications of Swedlow products and methods.

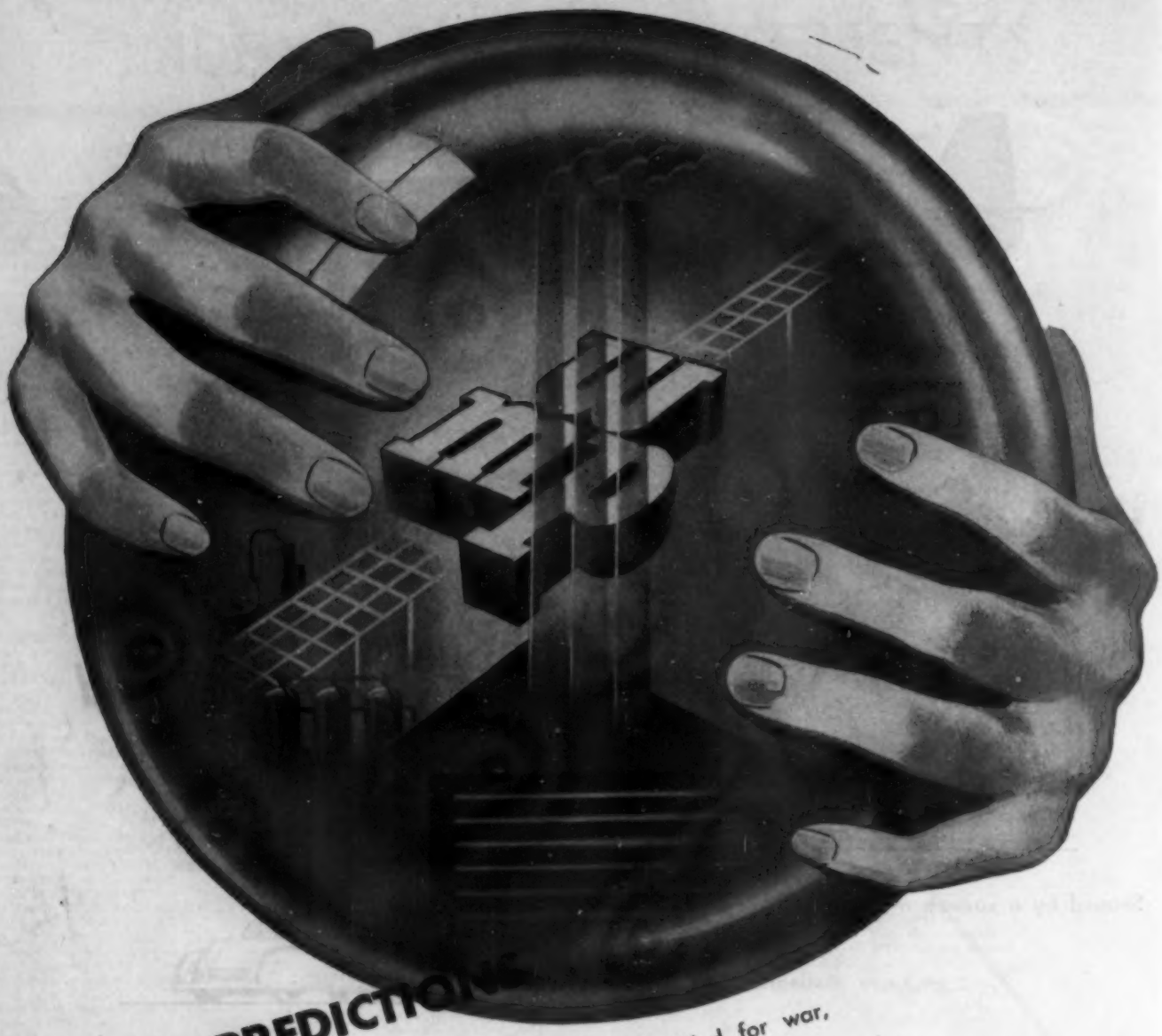
SHELLMAR

PRODUCTS COMPANY

Plastics Division

(Formerly Swedlow Aeroplastics Corp.)

GLENDALE, CALIFORNIA



PLASTICS PREDICTIONS

FOR YOUR FUTURE PLANS

The long line of plastics products we have injection-moulded for war, industrial and consumer use, bear little outward evidence of their die design origins, or the skilled engineering required to interpret these designs in die moulds. Almost every one of these products has served to broaden greatly the field of plastics applications.

In our new plant, quadruple our former quarters, these techniques are ideally matched by increased moulding capacities — equipment entirely of our own design and construction. You will make no mistake by including the Trio in any of your plans, current or future, which may call for plastics, or by borrowing the time to pay us a visit.

Custom Injection Moulding

WORCESTER MOULDED PLASTICS CO.

14 HYGEIA STREET, WORCESTER 8, MASS.

17 East 42nd St., New York 17, N. Y.
Export Office: 90 Broad St., New York 4, N. Y.

FOR CUSTOM INJECTION MOULDING . . . TRY THE TRIO

There's Daddy!

Yes, Betsy, your daddy's home, and just as glad as you are! In fact, he and his whole bomber crew have a lot to be glad for. They had a tight go on last week's mission to Bremen.

Their Fortress was badly crippled over the target, and lost her formation. It was 60 below outside and outrageously cold in the riddled plane. Compasses, gyros, and needles froze in their tracks while the plane slogged on through heavy cloud. In seconds they'd be hopelessly lost over powerful German defenses. The navigator tore off his gloves and seized his E-6B dead-reckoning computor, the only instrument that could still be used. Swiftly he synchronized the frozen readings of ground speed, heading, wind direction, fuel consumption. The skill and courage of the pilot and navigator brought them in safely, by the most direct route.

Dead-reckoning instruments speed the homeward trip in many such emergencies. This computor, made for the Weems System of Navigation, was VINYLITE plastic. It didn't freeze the navigator's fingers as metal might have done. Cold couldn't affect its operation or its accuracy. The entire combination of properties of VINYLITE plastic rigid sheets has made them a first choice for a vast range of navigating, computing, drafting, and measuring instruments.

Write Department 7 for booklet "VINYLITE Rigid Sheets", which gives detailed information.

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